Eco-anxiety and climate-anxiety linked to indirect exposure: A scoping review of empirical research

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A B S T R A C T

Psychological responses to knowledge about the risks of climate change and other global environmental problems (referred to as climate anxiety or eco-anxiety) are distinct from the psychological impacts of direct exposure and increased physical vulnerability to environmental phenomena. Previous scoping reviews have either focused on both direct and indirect impacts together or a particular target population. We conducted a scoping review of the literature on indirect exposure to identify the body of published studies in this area, which methodologies are informing this field, what populations are being studied, as well as what interventions are being developed.

We searched four databases (Web of Science, PsycInfo, MEDLINE, and Engineering village) and grey literature for English language studies between 2000–August 2023, and identified 90 published articles meeting our search criteria. The majority (80%) of the articles were published since 2020, primarily in Europe, North America, and Australasia.

More than half of the studies were quantitative and most of these focused on development of measurement tools (12 types). The Climate Change Anxiety Scale and the Hogg Eco-anxiety scale are the measures with the most validation studies. Risk factors repeatedly examined were age, gender, ethnicity, anxiety, depression, and pro-environmental behaviours. Qualitative (n = 13) and mixed methods studies (n = 7) were less common and focused on populations such as activists, scientists, children and parents, young adults, and self-identifying climate-sensitive individuals. Intervention studies were varied in nature, predominantly group-based and evaluated qualitatively or in single armed studies, with only one study using a comparison group.

Climate anxiety is a rapidly expanding research topic and there are increasing studies outside of WEIRD nations. The progress made in developing validated measurement tools for this relatively new phenomenon could be complemented by more qualitative and mixed methods approaches. Interventions are being implemented, but the research on interventions is in its infancy. There is an urgency to progress this field, not only to learn how to respond to those with debilitating distress but also to understand how to harness our emotional responses towards positive action related to global environmental concerns.

1. Introduction

Climate change is evidenced to impact physical health on a global scale, ranging from changing epidemiology of infectious diseases (Van de Vuurst & Escobar, 2023) to deaths related to heatwaves (Klingelhöfer, Braun, Brüggmann, & Groneberg, 2023). In comparison, psychological responses to climate change are only recently receiving recognition by the IPCC (Lee et al., 2023) and are missing entirely in government debates (Pirkle, Jennings, Vercammen, & Lawrance, 2022).

This is despite emerging evidence showing detrimental impacts on mental wellbeing through a range of hypothesised direct and indirect pathways (Corvalan et al., 2022). The proposed direct pathways include first-hand experiences and responses to increased physical vulnerability from climate change events. Such exposure has been associated with mental health conditions, ranging from Post Traumatic Stress Disorder (Cianconi, Betro, & Janiri, 2020) and psychological distress (Raker et al., 2019) to anxiety and depression (Matthews et al., 2019); see Walinski et al. (2023) for a comprehensive breakdown.

Indirect pathways refer to the cognitive distress and emotional worry or concern in response to climate change in the absence of experiencing an event. These psychological responses to climate change are expressed through a range of climate emotions (Pihkala, 2022b), which are manifested as practical (Clayton, 2020; Pihkala, 2020) or potentially pathological forms (Clayton & Karazsia, 2020) of 'eco-anxiety' and 'climate anxiety'. An early review (Coffey, Bhullar, Durkin, Islam, & Usher, 2021) highlighted the ambiguity in how these terms were operationalised in the literature with an array of subjective definitions. Subsequent research has utilised methods such as conceptual analysis (Pihkala, 2022a) and emotion theory (Kurth & Pihkala, 2022) to understand the development of the underlying psychological concepts and processes. In this paper, we adopt definitions from recent work by Cianconi et al. (2023) whereby climate anxiety refers to a continuum of negative emotional, thought-based and potentially behavioural responses to knowing about the existential risk of climate change, while the term eco-anxiety extends the emotional concept to awareness of the wider ecological crisis.

Whilst research has progressed the field conceptually, there remain important uncertainties within climate change psychology. For example, the different vulnerability factors of certain populations and demographics are not clearly ascertained, especially regarding the relationship with existing mental health disorders (Sampaio & Sequeira, 2022). Furthermore, two recent reviews (Baudon & Jachens, 2021; Bingley et al., 2022) highlight a lack of development and evaluation of intervention strategies for individuals with eco-anxiety and climate anxiety, which can leave therapists feeling underprepared to help climate anxious clients (Gawrych & Holka-Pokorska, 2022; Seaman, 2016).

Past reviews mapping the literature have resulted in two key areas of focus: exploring the direct pathways of climate change on mental health (Aylward, Cunsolo, Vriezen, & Harper, 2022; Walinski et al., 2023), and reviewing the disproportionate impacts on children and young people (Crandon, Scott, Charlson, & Thomas, 2022; Léger-Goodes et al., 2022; Ma, Moore, & Cleary, 2022; Ramadan et al., 2023). The literature is currently dominated by studies relating mental health to direct climate events (Ma et al., 2022). However, the rapidly growing nature of the field requires close monitoring of developments across all pathways of climate change on mental health. To this point, we are aware of only four reviews which exclude studies reporting psychological presentations resulting from physical vulnerability to climate change events (i.e., direct pathways). In each case, there was an alternate priority research focus: qualitative studies (Soutar & Wand, 2022), youth concerns (Martin, Reilly, Everitt, & Gillil, 2021; Ramadan et al., 2023) and eco-anxiety interventions (Baudon & Jachens, 2021). To address this shortfall, we conducted a scoping review on the indirect impacts of climate change on mental health across peer-reviewed and grey literature sources within the field of climate change and eco-anxiety. We aimed to investigate the development of empirical research in the field in accordance with the following research questions:

1) How has the qualitative literature examined climate and eco-anxiety and in what populations?
2) What quantitative measurement tools have been developed, what populations have they been applied to and what associated factors (i. e. risk or protective factors) have been studied?
3) What intervention studies exist to pragmatically inform future intervention efforts by proposing, implementing, and/or evaluating strategies to manage climate and eco-anxiety?

2. Methods

We conducted the scoping review in accordance with the Joanna Briggs Institute scoping review guidelines (Peters et al., 2021) and reported using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines

(Tricco et al., 2018).

2.1. Eligibility criteria

To be included in the review, articles needed to meet the following criteria: 1) be empirical studies (including qualitative, quantitative and mixed method), excluding commentaries, book chapters, discussions and review papers; 2) be published between January 2000 and August 2023 to cover the entire development of the concepts; 3) be written in English for practicality; 4) evolve the concept of eco-/climate anxiety using qualitative techniques OR by developing/implementing measurement tools OR developing/implementing intervention strategies; 5) address the indirect mental health impacts of climate change. This criterion deviates from past scoping reviews targeting indirect exposure to climate change (Baudon & Jachens, 2021; Ramadan et al., 2023; Soutar & Wand, 2022). Primarily, these reviews include studies sampling populations of increased physical vulnerability to climate change impacts (for example, farming communities or residents of atoll nations), who are likely to experience both direct and indirect exposure over time with simultaneous impacts on mental wellbeing (Corvalan et al., 2022). In addition, we also excluded articles which examined people's broader perceptions rather than emotional/mental wellbeing in relation to climate change and environmental issues.

2.2. Information sources and search strategy

An initial preliminary literature search of Web of Science and APA PsycInfo in July 2023 extracted a pool of keywords on the topic of climate/ecological change and emotional/mental wellbeing. Including all the terms yielded a prohibitive number of results, therefore, alongside consultation with a university librarian, we refined the full search strategy to accommodate the most prevalent terms in the literature, whilst capturing the prominent terms adopted in past reviews on eco-anxiety and climate-anxiety (Table 1). The search was implemented in July 2023, with ongoing search alerts until the end of August 2023, across four databases covering a range of scientific disciplines. All results were transferred into EndNote 21 for initial duplicate removal (100% match) and subsequently imported to Rayyan screening software for further de-duplication (95% match).

2.3. Grey literature

An early finding from our scoping study was a paucity of research examining the effectiveness of interventions for climate anxiety. Therefore, recognising the novelty of climate change anxiety and eco-anxiety interventions in research, we also conducted a grey literature search for empirical intervention studies meeting our search criteria. When supported, we adopted the same search strategy (Table 1) with the addition of an AND 'intervention' clause to restrict the results. If the database did not support the advanced search, we used 'climate change anxiety interventions' OR 'eco-anxiety interventions' as our search terms. We searched the grey literature databases: ProQuest Dissertations and Thesis; EBSCO OpenDissertations; Web of Science Conference

Table 1
- Web of Science search strategy terms.

#1 Climate Change	TS = (eco-* OR "climate change" OR ecological)
#2 Mental Health	TS= (anxi* OR solastalgia OR distress OR betrayal OR worr* OR "cognitive* emotion*" OR "function* impair*")
#3 Publication Year	(PY = = ("2023" OR "2022" OR "2021" OR "2020" OR "2019" OR "2018" OR "2017" OR "2016" OR "2015" OR "2014" OR "2013" OR "2002" OR "2003" OR "2004" OR "2005" OR "2006" OR "2007" OR "2008" OR "2009" OR "2010" OR "2011" OR "2012" OR "2001" OR "2000")
#4 Language	LA = = ("ENGLISH")
#1 AND #2 AND #3 AND #4	5000 search results

Proceedings Citation Indexes (CPCI–S and CPCI-SSH); BASE; Mednar and Google Scholar. Google Scholar produced over 300,000 results and therefore we only screened the first 100 results by relevancy. Furthermore, we carried out extensive google searches to report access to interventions available through charities, NGO's and international bodies etc. (available in supplementary material).

2.4. Source selection

Title and abstract screening were conducted in Rayyan software. Following a pilot sample of 60 studies, blindly reviewed by [initials removed for anon] and [initials removed for anon], the remaining abstract screening was conducted by [initials removed for anon] in accordance with the inclusion criteria. The potentially relevant sources were uploaded to an EndNote 21 library and all full text copies were retrieved when available online or via the university library service.

Full-text screening was conducted by [initials removed for anon]; any studies in doubt of inclusion were discussed with [initials removed for anon] until a consensus was reached. The grey literature database results were separately screened in the same manner as the peer-reviewed literature.

2.5. Data charting

Data was extracted using data charts following principles set out by Pollock et al. (2023). To facilitate the comprehensive nature of the review's aims, data charting was consistent across all four types of study design (quantitative, qualitative, mixed method and intervention) and included: 1) Sample - comprising the population nationality, demographic, size, and recruitment methods; 2) Methodology - including quantitative measurement tools, thematic analysis and evaluation methods of interventions; 3) Outcome - key climate change and mental
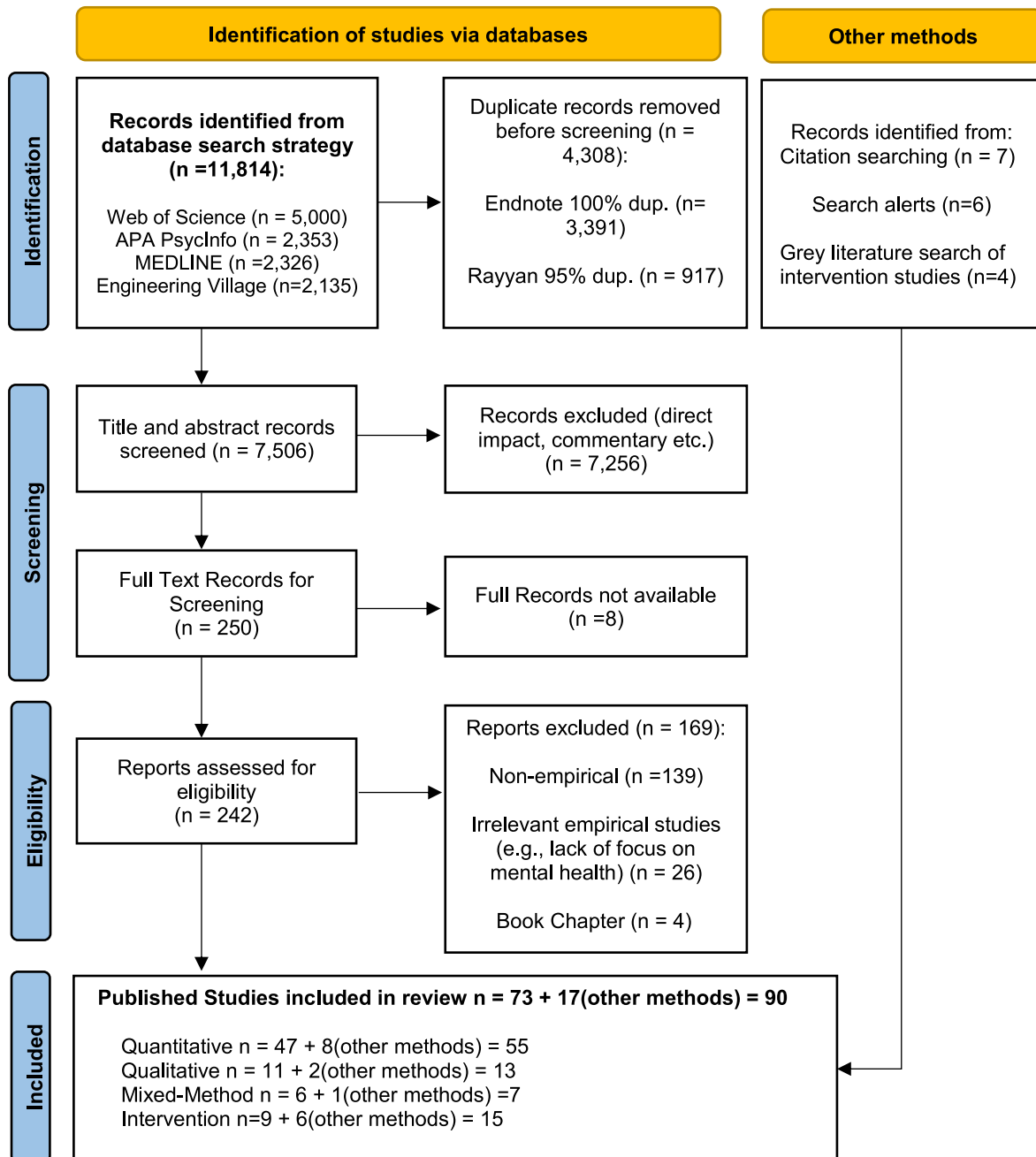

Fig. 1. Prisma diagram.

health/emotional findings, correlates with risk factors, as well as suggestions for future research where appropriate. Quantitative and intervention studies were independently charted by [initials removed for anon], whilst qualitative and mixed method studies by [initials removed for anon]; all charting was iterative and reviewed by all authors during project meetings.

3. Results

The search screening process resulted in 86 articles, supplemented by four additional published intervention studies from the grey literature search, totalling 90 empirical studies included in our review (see Fig. 1). Grouped by location, almost half (n = 42) used European samples (see Fig. 2 for complete breakdown). We categorised studies into quantitative (n = 55), qualitative (n = 13), mixed method (n = 7) and intervention (n = 15) studies to address the research questions.

3.1. Qualitative

We identified 13 qualitative studies, of which nine exclusively conducted in-depth/semi-structured interviews followed by thematic analysis (n = 7) or Interpretive Phenomenological analysis (IPA) (n = 2). One used a focus group session with grounded theory and symbolic interaction analysis (Thomas, Martin, Wicker, & Benoit, 2022), one a qualitative survey method and content analysis (Parry, McCarthy, & Clark, 2021), and one a hybrid approach of interviews and focus groups within participatory action research (Noy et al., 2022).

Most of the qualitative research has been conducted in Europe (n = 7), followed by Australasia (n = 4), with only one study in North America (Thomas et al., 2022). Three studies explored youth experiences with Parry et al. (2021) focusing on the role of digital media. The remaining studies recruited a variety of age groups. In three cases, study populations were amongst the professional sphere, namely climate scientists (Head & Harada, 2017), frontline environmentalists (Noy et al., 2022) and therapists (Silva & Coburn, 2023). Two studies targeted climate activists, reporting emotional experiences/interactions and the transition of anxiety into action (Bright & Eames, 2022; Kleres & Wettergren, 2017). Four studies sampled the emotional response of self-identified climate-sensitive individuals (Agoston, Csaba, et al., 2022; Marczak, Winkowska, Chaton-Østlie, Morote Rios, & Klöckner, 2023; Rehling, 2022; Zaremba et al., 2022) and two used a sample of past psychotherapy clients who expressed concern about the climate (Budziszewska & Jonsson, 2021, 2022). Only one study recruited participants from the general public with no required pre-requisite of climate concern (Thomas et al., 2022).

3.2. Mixed method

Our search identified only seven mixed method studies, four of which were published since 2022. Six of the studies collected qualitative and quantitative data and analysed these concurrently. Four of the studies analysed responses to open and closed survey questions (Baker, Clayton, & Bragg, 2021; Ojala, 2012b; Schwartz et al., 2022; Vercammen, Oswald, & Lawrance, 2023), and two used semi-structured interviews combined with a survey (Gunasiri et al., 2022; Léger-Goodes et al., 2023). Three validated scales were implemented: the Climate Change Anxiety Scale (CCAS) (Schwartz et al., 2022), the Climate Distress Scale (CDS) (Vercammen et al., 2023) and the Climate Change Worry Scale (CCWS) (Léger-Goodes et al., 2023), whilst other studies used unvalidated Likert style questions. One study utilised Q methodology to generate statements describing discourses on the topic (Takshe, Hashi, Mohammed, & Astari, 2022). Schwartz et al. (2022) and Vercammen et al. (2023) carried out additional quantitative analysis independent of qualitative data analysis using validated scales, which are included in the quantitative study charting below for completeness.

The mixed method studies recruited Australian parents and teachers (Baker et al., 2021), Australian young people and youth services managers (Gunasiri et al., 2022), children and parents in Quebec (Léger-Goodes et al., 2023), Swedish young people (Ojala, 2012a) and environmentalists, municipal workers, academics, and university students across the UAE (Takshe et al., 2022).

As well as the above studies, there were three studies that we listed as quantitative which drew on qualitative methods to develop or refine measurement tools (Agoston, Csaba, et al., 2022; Hogg, Stanley, O'Brien, Wilson, & Watsford, 2021; Stevenson & Peterson, 2016).

3.3. Quantitative

We identified fifty-five quantitative studies in the literature search, with 47 studies from the scoping review and eight studies from other methods. To address our aim to identify quantitative measurement tools, we focused on purely quantitative studies which either developed (n = 12) or implemented (n = 27) a measure of climate change anxiety/eco-anxiety, or associated eco-emotions, since 2000 (see Table 2). Therefore, studies which adopted unvalidated quantitative survey techniques (n = 16) were not charted (Berry & Peel, 2015; Clayton, Pihkala, Wray, & Marks, 2023; Ekholm & Olofsson, 2017; Hickman et al., 2021; Leonhardt, Granrud, Bonsaksen, & Lien, 2022; Maran & Begotti, 2021;
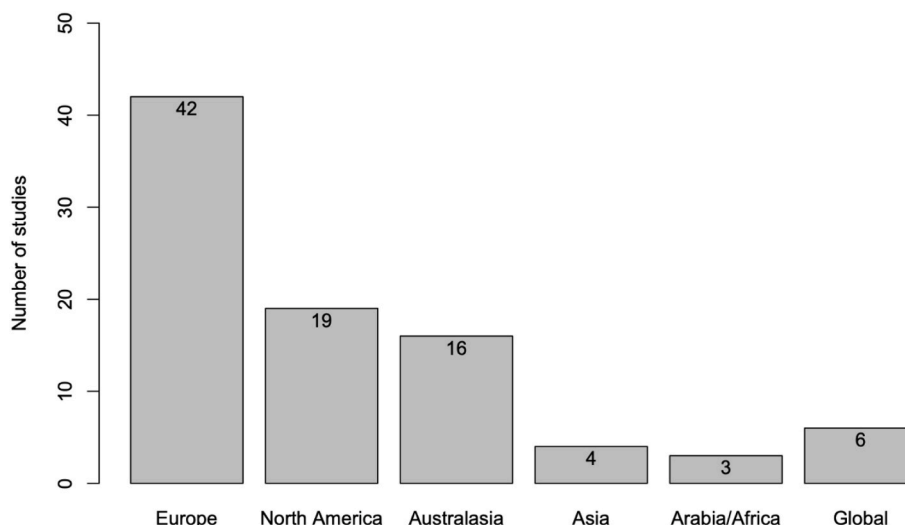

Fig. 2. Study location breakdown.

Table 2
Forty-one quantitative studies included in the review.

Reference	Country/Age/Population	Methodology	Outcomes
Climate Change Anxiety Scale (CCAS) 5 or 7 item Likert Scale			
Original Study: Clayton and Karazsia (2020)	U.S., (S1) n = 197, 60% male, 18–75 years. (S2) n = 199, 69% male, 18–84 years. (S3) n = 217, 65% male, 18–64 years. Representative samples all recruited from Amazon Mechanical Turk.	S1 EFA and S2 CFA (both four-factor accepted). Self-efficacy, personal CC experience, anxiety/depression, environmental identity measure.	Four-factor subscale identified. CCA correlated with emotional but not behavioural responses to climate change.
Chung, Jang, and Lee (2023)-parent study Jang, Chung, and Lee (2023)		Secondary data analysis. Korean CCAS, Climate Change Risk Perception Inventory and unvalidated Environmental Sustainability Interest item.	Eco-anxiety was the best predictor of environmental sustainability interest, tying into a 'practical' anxiety.
Cruz and High (2022)	U.S., n = 513, mean age = 52, 60% female, recruited from Qualtrics Panels.	Original CCAS - CFA (original two-factor rejected, modified two-factor accepted). Short forms of the Spielberger State-Trait Anxiety Inventory and CES Depression Scale.	The CCAS fits with the custom first and second-order model. Discriminant validity with measures of anxiety and depression.
Daeninck, Kioupi, and Vercammen (2023)	Current UK university students, n = 473 (environmental degree n = 249), mean age = 24, 53% female. Recruited via Qualtrics platform.	Original CCAS and coping strategy scale.	Environmental students have higher rates of CCA and use coping strategies more compared to other degrees.
Feather and Williams (2022)	Australia and New Zealand, n = 771, 18–81 years, 50% male. Recruited via Prolific platform.	Modified CCAS (removed six-items), Climate Change Concern Index, PHQ-4, Psychological flexibility Inventory (MPFI).	Psychological inflexibility moderates the relationship between climate-distress and climate concern.
Hajek and Konig (2022a)	Germany, (a/b n = 3091, 2023 n = 3015), 18–74 years, 50% male. Cross-sectional data from a quota based online survey.	German CCAS, Coronavirus Anxiety Scale and Fear of conventional war for correlations.	Low mean level of CCA (inconsistently differed between sub-groups). Strong correlations with COVID anxiety.
Hajek and Konig (2022b)		German CCAS, De Jong Giervald Loneliness Scale and Perceived Social Isolation Item.	Higher CCA positively associated with loneliness and perceived isolation across all age groups (except 65–74).
Hajek and Konig (2023)		German CCAS and Expected Longevity item.	Higher CCA associated with lower perceived longevity. Significantly correlated with 18–29 age group.
Heeren, Mouguiama-Daouda, and Contreras (2022)	French Speaking from France and Belgium (plus Switzerland, Gabon, Rwanda, Morocco, Algeria), n = 2080, 17–84 years, 52% female.	French CCAS, PEB scale and experience with climate change.	Women and young people had significantly higher levels of CCA. Significant association with PEB but suggest eco-paralysis in those with very high levels of CCA.
Heeren, Mouguiama-Daouda, and McNally (2023)	French Speaking (France, Belgium and Switzerland), n = 874, 18–81 years (mean 38), 51% female. Recruited via social media.	French CCAS, PEB scale, experience of climate change and general worry questionnaire. Used graphical Gaussian model and direct acyclic graph to examine CCA variable pathways.	Both models suggest the cognitive-emotional features of CCA are most prominent.
Innocenti et al. (2021)	Italian nationals, n = 130, 19–76 years, 67% female. Recruited via snowball sampling.	Longitudinal (3 months). EFA (one-factor accepted), CFA (no model accepted). PEB scale, Self-Efficacy scale, GAD-7 and Kessler Psychological Distress Scale.	Italian CCAS had good reliability for CI and worse for FI. CCA was related to anxiety, PEB and low Self-Efficacy.
Innocenti et al. (2023)	Italian residents, n = 394, 19–76 years, 64% female. Recruited via snowballing method.	Cross-sectional. Italian CCAS, PEB scale and Self-Efficacy Scale.	CCA has a twofold impact on PEBs. Direct positive effect (coping mechanism) or indirect impact mediated through negative relationship with self-efficacy.
Jang et al. (2023)	Korean nationals, n = 459, 19–65 years (mean 44), 51% female. Excluded those with diagnosed mental health disorders.	Cross-sectional. Validity- EFA and CFA (both two-factor accepted). Unidimensionality - CFA (two-factor accepted). Korean CCAS and Future Event Questionnaire.	Korean CCAS proved to be valid and reliable measure. Lower levels of CCA compared to other nations but important for cross-cultural comparison.
Larionow et al. (2022)	Polish nationals, n = 603, 18–70 years, 57% female. Recruited via online social networks.	EFA (three-factor accepted) and CFA (two and three-factor accepted). Polish CCAS and 8 scales (inc. PEB, PHQ-4 and personal CC experience).	Low overall CCA levels, women and younger people scored higher. CCAS related to PEB and depression but not anxiety.
Lukacs et al. (2023)	British Colombia, Canada residents. n = 1553 across three waves, 16–65+ years, 50% male.	Secondary data analysis. CFA (three-factor accepted), K6 psychological distress scale, climate behavioural engagement (six items from CCAS).	Higher CCA associated with psychological distress. CCA associated with greater PEB (termed concerned steward effect), effect is strongest among those with lower levels of distress.
Lutz et al. (2023), S5	(S5) Psychology students at Carleton University, Canada, n = 308, 17–47 years (mean 20), 78% female.	Original CCAS, Environmental Concern Scale, Pro-environmental Orientation Scale, measures of well-being.	CCAS scores were low (1.61 mean). Positive associations between CCA and self-reported depression and anxiety, as well as with PEBs.
Mouguiama-Daouda, Blanchard, Coussement, and Heeren (2022)	French Speaking. (S1) n = 305, 17–70 years, 72% female. (S2) n = 905, 17–77 years, 55% women. Recruited via social media and listserv ads.	Cross-sectional. S1 and S2 CFA (both two-factor accepted). French CCAS, Environmental Identity Scale, GAD-7 and BDI-11.	Two-factor structure best fit across both studies. Both FI and CI shared a positive association with depression and environmental identity.
Ramirez-Lopez, Rosetti, and Poma (2023)	Mexican undergraduate students (n = 461), 18–25 years, 64% female.	Online questionnaire, Original CCAS, GAD, Pro-sociality scale, climate education survey.	Overall CCA scores were low. Women, climate knowledge and prosocial behaviour all positively associated with CA (p < 0.05) but not GAD. GAD and CCAS are different measures of the same construct.
Reyes, Carmen, Luminarias, Mangulabnan, and Ogunbode (2023)	Filipinos' residents, n = 433, 18–26 years, 66% female.	Original CCAS and Mental Health Inventory.	Significant relationship between CCA and psychological distress but not with psychological well-being.

Table 2 (*continued*)

Reference	Country/Age/Population	Methodology	Outcomes
Schwartz et al. (2022)	US students aged 18–35, n = 284.	Original CCAS including climate action questions, Environmental Actions Scale (adapted), PHQ8, GADS7, Climate Change Experience.	Both the CCA subscales were associated with GAD symptoms, only CCA functional impairment was associated with higher MDD symptoms. Climate activism moderated the association between CCA cognitive emotional impairment and MDD symptoms.
Simon, Pakingan, and Aruta (2022)	Filipino undergraduate students from a private university, n = 452, gender mix not specified, (mean age 19).	Cross-sectional. CFA of four competing models (two-factor accepted). Filipino CCAS, experience of climate change and PEB items.	CCAS sub-scales have clear mediating roles in linking climate engagement behaviour with climate change experience in Filipinos.
Tam, Chan, and Clayton (2023)	China, India, Japan and U.S. n = 4000 (1000 from each country). All nationally representative samples.	Original CCAS - Individual and multigroup CFA (two-factor accepted). Climate action measure.	CCAS validated outside of WEIRD countries. CCA higher in China and India possibly linked to vulnerability.
Vercammen et al. (2023)	n = 539 UK residents, 16–24 years, 60% female. Snowballing method.	Climate Distress Scale, PHQ-9, climate experience questions.	Being female, family affluence and mental health diagnosis or treatment were associated with higher climate distress.
Whitmarsh et al. (2022)	UK public. (T1 n = 1338), (T2 n = 891), 18–85 years, 53% female.	Longitudinal (2 years). Original CCAS and 10 measures inc. PEB scale, GAD-7 experience of CC.	High levels of climate concern but low levels of CCA. Highest among younger people and those with general anxiety. Varied correlations with a range of PEB types.
Wullenkord, Troger, Hamann, Loy, and Reese (2021)	Germany, n = 1011, 18–69 years, 51% female. Recruited via SoSci-Survey platform.	Cross-sectional. EFA and CFA (no model accepted), single structure adopted. German CCAS, PHQ-4 and PEB item scale.	Could not replicate original scale factor structure. Low levels of CCA, positive correlations with anxiety and depression, PEB and climate change avoidance.
Zacher and Rudolph (2023)	Germany, n = 2,066, 18–85 years (mean 47), 50% female. Not representative - 43% had college/university degrees, excluded children and unemployed.	Longitudinal (4 months). German CCAS and basic environmental knowledge test, environmental attitudes.	Environmental knowledge is negatively related to climate change anxiety.
Climate Change Anxiety Scale Short Form (CCAS-S) 4 items			
Wu et al. (2023)	Canadian students (15–18 years) in the Youth Development Instrument (YDI) survey. (S1) n = 60, 16–17 years, no gender mix (S2) n = 2306, mean age 16, 46% female.	Cross-sectional (S1) Full CCAS piloted on n = 60 students, n = 34 for consultation creating the CCAS-S. (S2) EFA and CFA (one-factor accepted) for CCAS-S, Climate change Concern, PHQ-8, GAD-2 and life satisfaction scale.	Validity evidence for short CCAS in young adolescents (items drawn from both FI and CI factors). Positive association between CCA and GAD and depression. Negatively associated with overall mental health.
Hogg Eco-Anxiety Scale (HEAS-13) 4-item Likert scale			
Hogg et al. (2021)	(S1) Australia and New Zealand undergraduate students at the university of Canberra, n = 334, 17–65 years, 59% female. (S2) Undergraduate students at Victoria University Wellington, EFA - n = 365, (79% female) CFA -n = 370 (69% female), both (75% female, mean age 19). (S3) n = 189.	(S1) Initial 7-item scale based on GAD-7, self-identified eco-anxiety and open-ended questions. (S2) EFA and CFA (both four-factor accepted) to test new items on eco-anxiety-driven rumination. (S3) Longitudinal sample (12 weeks) for those in both EFA and CFA.	A unique 4 dimensional structures, 13-item Hogg Eco-Anxiety Scale (HEAS) measure validated longitudinally.
Hogg, Stanley, and O'Brien (2023) (Tests all existing structures)	Australia, n = 530, 18–86 years, 63% female. 347 with bachelor's degree or higher.	Original CCAS and HEAS - HEAS CFA (four-factor accepted), CCAS CFA (three-factor accepted, one and two-factor modified accepted).	Good support for the four-factor HEAS and mixed results for CCAS factor models. The CCAS and HEAS are related but explore separate concepts of environment-related anxiety.
Uzun et al. (2022)	Turkish residents, n = 698, mean age 23, 72% female.	Turkish Eco-anxiety scale - EFA (three and four-factor accepted), CFA (four-factor accepted).	The Turkish eco-anxiety scale was valid and reliable in the population, keeping the same four-factor structure as the original scale.
Mathers-Jones and Todd (2023)	Australia, University of Sydney and Western Australia undergraduates, n = 96, 18–31 years, 70% female. All believers in climate change.	Baseline assessment of attentional bias via dot-probe, HEAS (adapted to one week), Depression-Anxiety and Stress Scale, followed by a week-long diary measuring daily emotion and PEB engagement.	Attentional bias variability moderated the relationship between eco-anxiety and PEB. Eco-anxiety predicted greater PEB adaptive responses, but only when attentional bias variability was low.
Pavani et al. (2023)	France, (T1) n = 350 adults, 18–76 years, female 69%. (T2) n = 167 adults, 18–76 years, female 65%. Convenience sampling.	Two-wave longitudinal, interval 31 days on average (min 22, max 45). French HEAS CFA (one-factor accepted) n = 200 French adults, 18–81 years, 71% female, French validate PEB scale, Big Five Domains of Personality Inventory.	Eco-anxiety significantly motivated PEB longitudinally, even after controlling for ecological identity and Big Five personality.
Climate Change Distress and Impairment Scale (CC-DIS) (5-item Likert Scale)			
Hepp, Klein, Horsten, Urbild, and Lane (2023)	(S1) English speaking Europeans, n = 384, 18–65 years, 58% male. (S2) Native English only, n = 447, 18–75 years, 52% female. (S3) Native English, n = 374, 18–59 years, 50% female, more racially diverse. (S4) n = 494.	EFA and CFA (both five-factor accepted). S3-CCD and CCI items, BDI and GAD and environmental attitude measures. S4- PEB paradigm test.	The CC-DIS distinguishes between the affective experience of climate distress and functional impairment. CCD was prevalent but CCI was low across populations. Higher CCD and CCI are associated with a higher probability for PEB.
Climate Change Worry Scale (CCWS)			
Stewart (2021)	Undergraduate students from a southeastern U.S. university. (S1) n = 600, 18–51 years, 50% women. (S2) n = 54, mean age 21, 83% women. (S3) n = 417, 18–37 years, 85% female.	EFA and CFA (both one-factor accepted). CCWS and extreme weather experience survey. (S2). Longitudinal (two-week). (S3) CCWS and Depression, Anxiety and Stress Scale.	The CCWS is a single factor representing personal worry to climate change, validated longitudinally. Strong association to political belief and stress.
Climate Change Distress Scale (4-item Likert scale)			

Table 2 (*continued*)

Reference	Country/Age/Population	Methodology	Outcomes
Searle and Gow (2010)	Australia. University students (n = 173) and general public (n = 102), 57% 18–25 years, 61% female.	Cross-sectional. Climate Change Distress Scale - EFA (two-factor accepted). DASS (Depression and Anxiety measure), pro- environmental beliefs, Future anxiety scale.	First validated scale for climate distress composed of climate change anxiety and climate change hopelessness factors. Positive relationship between climate distress and anxiety/depression (p < 0.01), female, youth, and pro-environmental belief.
Climate Distress Scale (CDS) (5-item Likert)			
Reser, Bradley, and Ellul (2012)	National Australian sample. (S1) 2011, n = 4347, 15–55+ years, 54% female. (S2) 2010, n = 3096, 15–55+ years, 53% female. Both samples recruited from Qualtrics platform.	Scale analysis not available but pilot study conducted. 24 psychological measures inc. CDS, Self-Efficacy, PEB, coping/denial.	High levels of climate concern/acceptance among the population. Females, younger adults, and those with high self-efficacy and PEBs were associated with greater climate distress.
Climate Change Hope and Despair Scale			
Stevenson and Peterson (2016)	U.S. North Carolina middle school students, n = 1486 students, 11–15 years, 53% female.	Hope-Scale - EFA (one-factor accepted), PEB scale- EFA (three-factor accepted), Concern Scale - CFA (one-factor accepted. Asked science class teachers (n = 24) to survey their students. Cognitive interviews (n = 5) for item refinement.	No interaction between climate change hope, concern, or despair. Hope and concern are positively related whilst despair is negatively related to PEB. Low economic background students less likely to engage in PEBs.
Brief Climate Change Distress Scale (BCCDS) (5-item Likert)			
Latkin, Dayton, Scherkoske, Countess, and Thrul (2022)	U.S. Amazon Mturk, n = 775, mean age 40 years, 53% female.	Cross-sectional survey. No EFA or CFA but principal component analysis supported one factor. Climate change activism items, BCCDS, CED Depression Scale.	Climate Change Distress was consistently and independently positively related with climate activism.
Environmental Worry Questionnaire (EWQ) (5-item Likert)			
Gago and Sa (2021)	Portuguese University students, n = 106, 18–25 years, 70% female, 58% psychology students.	No EFA or CFA. EWQ, Brief Symptom Inventory, Coping with Environmental Problems Scale.	Young adults reported a moderate-to-high level of environmental worry, mainly associated with negative well-being.
Mental Health Problems related to Climate Change Questionnaire (MHPCCQ) (5-item Likert)			
Arnout (2023)	Residents of 18 Arab countries, n = 1080, 25–60 years, 51% female.	Cross-sectional survey. EFA (eight-factor accepted), two of which were climate anxiety and climate depression.	MHPCQQ climate anxiety scores were average. Significant (p < 0.05) climate anxiety differences across countries and marital status.
Eco-Guilt, Eco-Anxiety and Ecological Grief Questionnaire (4-item Likert)			
Agoston, Csaba, et al. (2022)	Hungary. (S1) n = 17, mean age 31 years, 35% male. (S2) n = 4068, mean age 43 years, 57% male, Large independent Hungarian news website, all in Hungarian. No mental health disorder.	3 EFA samples and one CFA sample - Eco-anxiety (two-factor accepted), guilt (one-factor accepted) and grief (modified one-factor accepted). (S1) Semi-structured interviews qualitative analysis drew 217 text fragments to inform item development. (S2) Item-pool questionnaires and PEB scale questions.	Successfully developed 3 validated eco-emotion questionnaires which all positively correlated with PEBs.

Abbreviations: General - CC= Climate Change, CCA = Climate Change Anxiety, PEB =Pro-Environmental Behaviour, S1,2,3 = Study no. Methods - CFA= Confirmatory Factor Analysis, EFA = Exploratory Factor Analysis, GAD = General Anxiety Disorder, BDI =Beck Depression Inventory. Climate Change Anxiety Scale (CCAS) factors - CI= Cognitive Impairment, FI= Functional Impairment. Hogg Eco-Anxiety Scale (HEAS) factors - AS = Affective Symptoms, R= Rumination, BS= Behavioural Symptoms, PA=Personal Impact Anxiety.

McBride, Hammond, Sibley, & Milfont, 2021; Ogunbode et al., 2021, 2022; Ojala, 2012a, 2013; Sangervo, Jylha, & Pihkala, 2022; Schwaab, Gebhardt, Friederich, & Nikendei, 2022; Sciberras & Fernando, 2021; Temte, Holzhauer, & Kushner, 2019; Verplanken, Marks, & Dobromir, 2020).

As noted above, two quantitative analyses from mixed methods studies were added to Table 2. Within the charted subset of literature, 31 of the 41 studies were published in 2022 or 2023. The literature was dominated by cross-sectional studies, with limited longitudinal designs (n = 6), three of which evaluated the measures for consistency over time (Hogg et al., 2021; Innocenti et al., 2021; Stewart, 2021), and three used the measures to analyse relationships between variables over time (Pavani, Nicolas, & Bonetto, 2023; Whitmarsh et al., 2022; Zacher & Rudolph, 2023).

3.3.1. Populations

Most study populations are European samples (n = 18). Half comprised German (Hajek & Konig, 2022a, 2022b, 2023; Wullenkord et al., 2021; Zacher & Rudolph, 2023) and French-speaking populations (Heeren et al., 2022, 2023; Mouguiama-Daouda et al., 2022; Pavani et al., 2023), with singular studies in Turkey (Uzun et al., 2022), Hungary (Agoston, Urban, et al., 2022), Poland (Larionow et al., 2022) and Portugal (Gago & Sa, 2021). We found just one study which implemented a measurement tool in a sample with a significant African

component (Arnout, 2023).

With the exception of eleven studies which either had male-dominated (Agoston, Urban, et al., 2022; Clayton & Karazsia, 2020; Hepp et al., 2023; Lukacs et al., 2023; Wu et al., 2023), equal (Feather & Williams, 2022; Hajek & Konig, 2022a, 2022b, 2023; Zacher & Rudolph, 2023), or unspecified (Simon et al., 2022) gender mixes, the majority (n = 28) of studies recruited female-dominated samples. Furthermore, 28 of the studies sampled public residents through online recruitment platforms, social networks, and convenience/snowball sampling, recruiting a wide range of age groups. The remainder targeted university (n = 9), middle school (11–15 years) (Stevenson & Peterson, 2016) and high school (15–18 years) (Wu et al., 2023) students.

3.3.2. Measurement tools

Our search revealed twelve versions of quantitative measurement tools. Of these twelve measures, nine have been structurally validated in at least one sample population using exploratory and/or confirmatory factor analyses (EFA/CFA). Both the Environmental Worry Questionnaire (EWQ) (Gago & Sa, 2021) and Brief Climate Change Distress Scale (BCCDS) (Latkin et al., 2022) perform no factor analysis, whilst the Climate Distress Scale (CDS) (Reser et al., 2012) reports but does not present a principal component factor analysis. Only four of the scales have been implemented in an empirical study outside of the original work; the Climate Change Anxiety Scale (CCAS), Hogg Eco-Anxiety

Scale (HEAS), CDS and Climate Change Worry Scale (CCWS). The most prevalent measurement scale within our search was assuredly the CCAS (Clayton & Karazsia, 2020) (n = 24), followed by the HEAS (Hogg et al., 2021) (n = 5).

3.3.3. Risk factors

Our aims included scoping the risk factors related to climate and eco-anxiety in the literature. Alongside demographic variables (e.g., age, gender, race), the two most prevalent risk factors reported were mental wellbeing (including measures of general anxiety and depression) (n = 21) and pro-environmental behaviours (PEBs) or environmental attitudes/identity (n = 19). Other measures adopted were personal climate change experience (n = 6), climate activism (n = 6), Self-Efficacy (n = 4) and environmental/climate knowledge (n = 2).

3.4. Interventions

Our third research aim was to identify studies across peer-reviewed and grey literature, which have either proposed, implemented and/or evaluated intervention strategies for climate change anxiety and eco-anxiety. Our published literature search yielded nine studies, which did not include the two empirical studies (Büchs, Hinton, & Smith, 2015; Gillespie, 2013) from a scoping review (Baudon & Jachens, 2021); these were subsequently added to our charting (see Table 3). Moreover, our search of grey literature databases added a further seven matches, two of which were published articles not captured in our initial search (Loll, Schmatz, von Lonski, Cremer, & Richter, 2023; Sarrasin, Henry, Massersey, & Graff, 2022). Whilst searching the grey literature, we also created a list of 23 interventions taking place in a variety of contexts (see supplementary materials).

3.4.1. Types of intervention

Of the 19 sources included, 15 were studies which report implementing an intervention strategy, whilst four outline a detailed methodology for a proposed intervention. The majority were group interventions with the exception of three studies (MacKay et al., 2020; Raile, 2023; Wortzel et al., 2022). The interventions predominantly target Climate Change Education (CCE) (n = 9) followed by adaptive coping mechanisms (n = 6), physical engagement (n = 3) and exposure (n = 1). Intervention designs include workshops/courses with group-work to explore eco-emotions, discussion of climate issues and channel action (n = 7); mindfulness exercises (n = 3); theatrical performance (n = 2); physical activity (n = 2); children's literature (n = 1); poetry therapy (n = 1); engagement with international governance (n = 1); educational lectures (n = 1) and exposure to the climate crisis (n = 1).

Across CCE, studies sought to mitigate eco-anxiety by facilitating the expression and self-reflection of eco-emotions (Büchs et al., 2015; Marks et al., 2023), encouraging community action/empowerment (Gallay et al., 2022; Trott, 2022), as well as providing agency to 'deflect' eco-anxiety (Gallay et al., 2022; Sarrasin et al., 2022). Adaptive coping approaches targeted the transformation of climate and eco-anxiety by challenging negative thinking through theatrical performance (Lehtonen & Pihkala, 2021), managing eco-anxiety as a 'fear' rather than a mental disorder (Raile, 2023), and channeling stress into eco-resilience through mindfulness and meditation (Wong & Carlson, 2020). Similarly, interventions adopting physical engagement aimed to develop hardiness and efficacy to build eco-resilience within both students and teachers (Hemsley, 2022; MacKay et al., 2020).

3.4.2. Populations

We only comment on the populations across implemented interventions (n = 15). With the exception of two studies (Büchs et al., 2015; Gillespie, 2013), all studies identified in our search were published after 2020 and based in either Europe (n = 7), North America (n = 6) or Australia (n = 1), although Wortzel et al. (2022) is available

online. The majority (n = 10) targeted youth in education systems, comprised middle school (n = 5), sixth form/college (n = 2) and university students (n = 3). Only two studies explored interventions across a diverse age range (Büchs et al., 2015; Loll et al., 2023) and just one focused on climate professionals and activists (Gillespie, 2013).

3.4.3. Intervention evaluation

Only four studies used pre and post course evaluation methods, all in the form of quantitative surveys. Loll et al. (2023) is the only case to conduct a clinical evaluation against a control group using a validated scale (CCAS), although Keene (2023) also outlines the use of the CCAS in their proposal. Four further studies had post-course quantitative surveys, which were completed either immediately (Gallay et al., 2022; Sarrasin et al., 2022), or at prolonged intervals after the event (Büchs et al., 2015; Marks et al., 2023). Nine studies included a thematic analysis after the intervention, drawn from qualitative surveys (n = 1), interviews (n = 2), focus groups (n = 3) and workshop scripts (n = 3).

4. Discussion

Our research aimed to identify and describe the body of research on the indirect psychological impacts of climate change and related global environmental crises, manifested in the literature as climate change anxiety and eco-anxiety. The scoping review centred on a comprehensive exploration of the research methods adopted, including the identification of intervention studies which either propose, implement, or evaluate strategies. We identified 86 peer reviewed empirical studies matching our criteria. To address the paucity of studies relating to interventions to tackle climate and eco-anxiety, we sourced a further ten studies involving interventions from grey literature sources.

As more regions are directly impacted by climate change and other negative environmental impacts, physically vulnerable groups are likely to experience increasingly simultaneous mental health/wellbeing impacts from direct and indirect exposure (Corvalan et al., 2022). Direct and indirect impacts are qualitatively different, therefore it is important to study both types separately where possible. The impact of being a bystander is important as the way we respond emotionally to these events affects both wellbeing and our ability to respond and take action to mitigate and adapt.

Recent reviews, exploring both direct (Ma et al., 2022; Walinski et al., 2023) and indirect (Léger-Goodes et al., 2022; Ramadan et al., 2023; Soutar & Wand, 2022) impacts of climate change on mental health, report mainly studies conducted in the USA and Australia. In contrast, our review identified a wider field of research, unveiling extensive studies across at least eight European countries and early signs of research in non W.E.I.R.D nations (western, educated, industrialized, rich, and democratic) (Nielsen, Haun, Kärtner, & Legare, 2017). As the psychological presentations of climate anxiety are observed globally and vary cross-culturally (Hickman et al., 2021), it is important for future work to endeavour to study populations comprising non-W.E.I.R.D. nations.

The acceleration of research on the indirect psychological impacts of climate change is exemplified by over 80% of the included studies being published during or after 2020. The necessity for our scoping review to map the development of recent research methods and interventions is reinforced when considering 25% of the literature (n = 23) has been published since the beginning of 2023.

Our first research question sought to uncover the recent methods and populations sampled in qualitative research, expanding on components of the qualitative systematic review by Soutar and Wand (2022). Across the qualitative and mixed method designs, there is minimal overlap between the studies in Soutar and Wand (2022) review and our work. We attribute this to the exclusion of studies exploring climate perceptions in our review (see Section 2.1) and that 11 of our 13 qualitative studies were published since the authors' search in 2020. We consider the sample populations of the qualitative studies against the emergent

Table 3

Eighteen intervention studies included in the review.

Reference	Sample	Interventions	Methodology	Outcomes
Climate Change Education (CCE)				
Büchs et al. (2015)	113 UK participants, 84 females, 89 over 30 years. High proportion of 'green' behaviours relative to the UK population.	Carbon Conversations. 6–8 participants meet 6 times over several weeks with trained facilitators. Meetings involve group discussions and games and tasks to complete at home. Provided with a handbook to educate on energy, travel, waste consumption, etc.	Online survey (n = 113 past participants) with self-reported Likert scale, semi-structured interviews (n = 26, 20 female) between 1 and 2 h.	From survey: 78% agreed taking part helped them take action to reduce carbon footprint; 50% agreed taking part reduced their worries about climate change. Interviews: Participants engaged with emotions deeply and some took quite radical reflections from the handbook. Group environment was good for moral support and expressing emotions.
Chandler (2023) **(Thesis)**	Targeted therapists.	Draws from the Marriage and Therapy field to create a training model (series of lectures) that equips therapists to deal with clients suffering from eco-anxiety.	No evaluation available.	This is a PROPOSED intervention for therapists based on a literature review, not an empirical study.
Eriksson et al. (2022) **(Conference paper)**	3rd yr BSc and 1st yr MSc Media technology students, n = 65, at KTH Royal Institute of Technology Stockholm, Sweden.	Weekly seminars for eco-anxiety in ICT run alongside an introductory sustainability course. Emotions from previous course iterations were reflected upon using interviews from past attendees. Course structure was evaluated and developed in line with the 'Eco-anxiety Education Framework' within Pihkala, 2020.	Student pre- and post-course evaluation; quantitative survey of emotions and emotional engagement.	Personal eco-anxiety expressed by both teachers and students. Storytelling and teacher panel additions showed that educators also suffer from eco-anxiety and offered students opportunities to discuss emotions. After the course students had an increased sense of hopelessness and decreased happiness ($p < 0.05$) but decreased anxiety ($p < 0.05$) relative to prior. Strong emotional responses among students were self-associated with positivity ($p < 0.01$) despite the emotions being largely negative.
Gallay, Furlan Brighente, Flanagan, and Lowenstein (2022)	U·S., n = 486 students, 12–18 years. 53% Female, 59% Black, 14% Asian.	Place-based civic science (PBCS) to educate children and young people on climate action and gain a sense of hope/eco-resilience. Teachers (n = 11) self-selected into the PBCS project that took place within regular school classes over semesters from 2014 to 2020.	Thematic analysis of student responses (n = 452) after the projects. Teachers selected students (n = 27) to participate in a public forum and answered qualitative prompts. Coded analysis of n = 7 student-led conference presentations.	No direct evidence that participation reduced climate-distress. The PBCS responses were replete with themes of empowerment through community action. Group identities 'deflected' eco-anxiety by installing trust in community collective action. Requires quantitative validation, but PBCS argued to provide powerful educational interventions to climate distress via teamwork, solidarity and installing hope.
Humby (2023) **(Thesis)**	Targeted small high school classes.	Eco-existential 'threatometer' (EET). Uses visuals-arts with emotional health literacy to support teachers and students in exploring environmental content that has emotional implications. Group discussions on action to take to engage with emotions.	No quantitative measure. Emphasised that this does not mean there is no impact - a process of cognitive interventions that reframe climate views.	This is a PROPOSED group intervention based on a literature review, not an empirical study.
Marks et al. (2023)	U·K., n = 4 sixth form students (16–18 years).	Pilot 3-h school workshop for exploring eco-emotions and addressing climate hope based upon Youth Participatory Action Research principles. Discussion of important climate issues; explore eco-emotions through video experiences; group-based illustration for hope building via writing/drawing and discussion.	Self-selected participants volunteered. Thematic analysis of the workshop; emotion analysis of the transcript, qualitative analysis of surveys 1 and 4 weeks after.	Emotional sentiment analysis revealed more positive than negative emotions. Three key themes from surveys: 1. Positivity listening to other perspectives on climate change 2. Creatively expressing emotions via illustration was well received. 3. 'Hope isn't enough' - need to bridge between realistic hope and action.
Sarrasin et al. (2022)	French Speaking Swiss adolescents (11–19 years) n = 169, 45% female from 144 sample.	4 Youth Climathons. Preparation - 8 h of environmental knowledge and future challenges from teachers during school. Project or narrative development in small groups and the winning project is implemented.	No pre-questionnaire. Evaluation from qualitative observation notes during three of the Climathon Days. n = 150 post questionnaire (mixed method questions) climate anxiety measured with single item, n = 3 teacher interviews.	Personal involvement in group work, self-efficacy and PEB were all related to higher CCA. Teachers agreed that efficacy beliefs in students arise from their families informing them. For future interventions- providing students with a sense of agency proved important when addressing climate worry and anxiety.
Trott (2022)	U·S., n = 55 children, 10–12 years. Three boys and girls' clubs over 15 weeks.	Multi-site after school CCE program - Science, Camera, Action (SCA), based on the 'Head, Hands, and Heart' model of Transformative	Self-selected with parent approval. Pre- and post-program quantitative survey. Thematic analysis of post-	After the program, children's pro-environmental attitudes were all stronger, greater respect for nature and sense of urgency toward climate

(*continued on next page*)

Table 3 (*continued*)

Reference	Sample	Interventions	Methodology	Outcomes
		Sustainability Learning. SCA involved Participatory Action Research (PAR) methods.	program focus groups (4–5 children per group, mean = 38 min).	action. Negative emotions (fear, worry, anger) with climate change were mitigated by positive emotions from youth-led family and community climate action projects.
Wortzel et al. (2022)	Targeted for teachers and parents to discuss with children.	Evidence-based children's picture book. Reviewed children's books on topic to synthesise a 'Climate Talk' process. Incorporated psychologically grounded approaches with footnote references to psychological resources to educate adults and learn more techniques for children.	No evaluation except for book reviews.	Book Title: ''Coco's Fire: Changing Climate Anxiety into Climate Action''. Positive reviews from schools and parents.
Adaptive Coping				
Cosgrove (2022) (Thesis)	U.S. Yale University students and friends/family. (n = 133 respondents).	Live outdoor immersive art performance in front of audiences. Storylines involve dialogues from climate scientists, exploring the forest with the audience to immerse with nature and brainstorming climate solutions.	Pre (n = 75) and post (n = 48) show quantitative survey responses on climate change opinions and emotions (including anxiety, fear, anger, and hope). Single qualitative question. Cast and crew (n = 14) post show survey.	Audience and cast members were emotionally engaged, but no significant changes in emotional responses pre and post show.
Gillespie (2013)	Sydney. A therapist (Gillespie) and n = 7 climate change activists, policy makers, artists, researchers, and social communicators.	Co-operative group discussions exploring dreamwork using depth psychology. 12 2-h meetings over 7 months.	In the final meeting, each participant reflected on all the discussions and validated their responses to climate change. Qualitative analysis of group responses.	Participants broadened their understanding of climate change based on each other's experiences. Sharing dreams developed empathy and motivated everyone to work with others to engage with global warming issues.
Lehtonen and Pihkala (2021)	Finland, 7–12 students from each school group (total amount not specified), 12–16 years.	CCE through six performance workshops (based on the principles of devising theatre) as part of school environmental conference days. An introductory lecture on climate change/environmental issues preceded creative workshops (prep 2.5 h) that students performed afterward (improvisation encouraged).	Not specified if self-selective or random. Post-workshop thematic analysis of performance scripts and video theatrical analysis of the manifestation of psychosocial issues. No post-discussion with students.	Performance arts offered valuable space for reflection and challenging negativity surrounding climate change for students. Three key themes (psychosocial dynamics, alienation, and tragedy) were drawn, concluding that creative encounters should be encouraged to provide opportunities for adaptive coping.
Raile (2023)	Austrian man (n = 1), 21 years, graduate. Suffers from eco- anxiety and depression. Previously had psychotherapy.	Poetry Therapy. 10 sessions (90 min) in a 14-day rotation. Session exercises included: diary across sessions; fear creative writing and thought experiment; short story on eco-anxiety; expressing the opposite of fear (hope) in creative writing. Exercises drawn from theory within Heimes's literature (German poetry therapist).	The patient approached the therapy for consultation. Extracts from patient exercises were analysed by therapist.	Emphasis on coping with eco-anxiety as a 'fear'; not removing it but managing it. The creative writing shifted his emotions from anxiety/ depression to anger and encouraged him to educate others. He continued exercises in his everyday life. Poetry therapy was effective but requires validation.
Wong and Carlson (2020)	College in Boston, U.S., n = 79, 1st year engineering students.	Mindfulness and sustainability intervention program over three years by a librarian team. Exercises included: Mindfulness-Based Stress Reduction (MBSR) meditation/ breathwork classes; Copenhagen 2009 (Climate Change game); Environmental movie night; Climate change stress talks using the World Café Method.	Students were self-selected and encouraged to attend via a 'passport incentive program'. Post-course survey (n = 58) using quantitative survey and open-ended questions.	98% of the students felt the techniques were 'a little bit helpful' at minimum for building climate/stress resilience. Most of the students maintained Meditation exercises in the future for anxiety.
Physical Engagement				
Hemsley (2022) (Masters Field Project)	Environmental Education students at Washington university (early teachers) (n = 19).	4 somatic intervention classes. Sensory awareness, bodily alignment, and temperature focused movement activities. Eco-anxiety and emotion teaching. Focus group discussion at the end.	Qualitative coding analysis of focus group recordings, reflective writing and drawing assignments and teacher reflection notes (n = 43 documents).	Students showed increased hardiness for taking on challenges and meaningfulness in their teaching for the environment. It provided an emotional outlet for difficult topics (mainly via movement). Teachers felt more prepared to bring emotions into a class setting and meet the needs of anxious students.
Keene (2023) (Thesis)	8 high school students aged 14 and up identified as eco-anxious in screening process.	18-week school-based scuba diving therapy course.	One-on-one screening interview before, same questions after course completion. Include Environmental Identity Scale, Climate Change Anxiety Scale and Environmental Distress Questionnaire.	This is a PROPOSED group intervention based on a literature review, not an empirical study.

Table 3 (*continued*)

Reference	Sample	Interventions	Methodology	Outcomes
MacKay, Parlee, and Karsgaard (2020)	Canadian Indigenous youth. n = 40 grade 10–11 students of which 6 went to COP24.	Engagement at a Youth knowledge Fair (YKF) with poster presentations at the University of Alberta. Six students were invited to participate in COP24 (Poland).	Thematic analysis of semi-structured interviews one year after (n = 14 students, n = 2 co-ordinators, n = 6 relations). Mapping activity to create webs of support for students.	Themes identified in thematic analysis. The YKF highlighted the link between climate change and lived experience (all students live off the land). Interviews expressed cultural pride, leadership, hope and efficacy about 'being heard' which are pathways to offsetting climate anxiety and building resilience.
Exposure				
Loll et al. (2023)	German, n = 70, 18–57 years (mean 24), 77% female. Snowball sampling.	Four media interventions groups (Control n = 19, Newspaper n = 21, Video n = 19, Radio n = 11). Participants randomly assigned and received one media input on climate crisis each day for 3 days (control group received divergent theme).	Pre-test: Big Five Personality Test and German CCAS. During: Confirmation of media consumption and check for external media influences. Post-test: German CCAS.	Significant change in CCAS score pre and post media intervention across all participants. No significant difference between control and media group. Only video significantly affected eco-anxiety.

Note: Charting of proposed/implemented/evaluated climate anxiety and eco-anxiety interventions. Studies identified from the grey literature database search have the document type highlighted in bracket after the author(s) and year reference.

Abbreviations: CCA (climate change anxiety), CCAS (Climate Change Anxiety scale), Climate Change Education (CCE).

themes that Soutar and Wand (2022) identified for scoping climate anxiety (population vulnerability, socio-economic status, and occupation). Studies commonly recruited participants who self-identified as having climate concern, a group expected to be more vulnerable to climate anxiety, as well as good representation of young people and adolescents, who are recognised as particularly vulnerable to climate distress (Ramadan et al., 2023). With regards to occupation, we found a mix of participants employed in the professional and public sphere. However, our review suggests a strong bias to ethnically 'white' populations in the developed world, with Rehling (2022) the only deviating account. This shortfall aligns with the under sampling of W.E.I.R.D. nations. Qualitative studies may be particularly relevant at this early stage in research on climate anxiety, to further refine our understanding of the range of relevant experiences for various groups in different contexts.

Qualitative research can also point to processes of change to inform our theoretical models. While there are a growing number of qualitative studies that have contributed to deepening our understanding, the number is still small and further qualitative research is needed. For example, qualitative studies could inform understanding of how some people may respond to climate anxiety with positive action, while others may become disempowered and functionally impaired.

Mixed method studies usually analysed qualitative and quantitative data concurrently. This approach can be helpful to assess where the psychometric tools and surveys are capturing the range of experiences commonly described, and where there are additional aspects of the experiences not encapsulated in the measure or survey. In one study, the qualitative data were analysed separately for two quantitatively defined groups (based on severity of distress), allowing the comparison of the experiences of these groups (Schwartz et al., 2022). We identified several studies that used a sequential mixed methods design. Some recent studies utilised qualitative interviews to contribute to the development of the measurement tool items. This approach is beneficial in grounding the measures in the experiences of the population of interest. This is important when the understanding of the nature of climate anxiety in different contexts is still developing (Zhou, 2019).

In addressing our second research question, research designs were dominated by quantitative methodologies. Much of the work focused on the development of measurement tools, measuring the prevalence of climate change anxiety in populations, and identifying associated risk factors. The Climate Change Anxiety Scale (CCAS) dominates research in the quantitative studies, while the Hogg Eco Anxiety Scale is gaining momentum. CCAS and HEAS are different measures of similar constructs (eco-anxiety vs climate anxiety), where HEAS has a broader application. Newly developed measures (i.e. short CCAS and CC-DIS) need to be

validated cross-culturally if they are going to be utilised in wider contexts.

Quantitative studies explored a wide range of risk factors, with some consensus on collecting data for age, gender, ethnicity, mental well-being, anxiety, depression, pro-environmental behaviours, environmental attitudes, and environmental identity. Differing measurement tools were used to capture these, and a wide range of additional measures were also used. The field could therefore benefit from some consensus research, such as using a Delphi method to identify which measures are most important to be included across studies (Nasa, Jain, & Juneja, 2021). Additionally, there is a necessity for further longitudinal studies to facilitate directional inferences of predictors, as well as to evaluate the prevalence of climate and eco-anxiety over time across diverse populations.

In answer to our third and final research question, we build upon the reviews of Baudon and Jachens (2021) and Bingley et al. (2022) who analyse non-empirical research related to climate anxiety interventions. Bingley et al. (2022) contextualise the literature into a framework for assessing the effectiveness of climate anxiety interventions in accordance with individual, social and environmental needs.

Baudon and Jachens (2021) identified psychoanalysis and ecotherapy to be the most prevalent psychological interventions for eco-anxiety, but unearthed only four empirical intervention studies. In comparison, our search highlights the benefits of conducting a grey literature search in a novel field as this doubled our intervention results and captured a broader variety of approaches. While there remain relatively few implemented interventions to address climate/eco-anxiety, and none which compare alternative interventions, we report a gradual expansion of intervention research, particularly in climate change education strategies targeted toward young people. The types of interventions we identified overlap with the Bingley et al. (2022) framework; they suggest interventions which focus on problem focused action, emotional management and social connection. Moreover, it is important for researchers to consider whether eco-anxiety interventions should aim to reduce eco-anxiety and/or transform it towards resilience or empowerment. Research which furthers understanding of the processes by which some people are empowered and others disempowered could highlight which purposes interventions should target for different groups.

While qualitative methods are appropriate to the evaluation of new interventions in an emerging field, we might expect more studies using quantitative evaluation drawing on validated tools and utilising comparison groups, which develops the main literature gap identified within Bingley et al. (2022). We would encourage a diversity of interventions that are grounded in understanding climate anxiety in a particular context. One example of how the types of interventions could be

broadened would be to study interventions connecting people with nature, as suggested by Baudon and Jachens (2021). Sequential mixed methods designs could be used so that qualitative insights in context can inform the development of interventions, for example, using the person-based approach (Morrison, Muller, Yardley, & Bradbury, 2018). Some interventions identified in our review have highlighted coping strategies focused on reducing symptoms, while other authors stress the need to facilitate the process of acceptance of climate change and promote action to mitigate and adapt to climate change (Fyke & Weaver, 2023).

The relationship between climate anxiety and mental health has had growing attention. Twenty-one studies included measures of anxiety and depression in their cross-sectional quantitative analysis, but only one study used a longitudinal approach to study this relationship (Whitmarsh et al., 2022). The limitations of cross-sectional studies are that it is difficult to understand how climate anxiety and mental health affect each other over time, for example, whether there is a bidirectional relationship. A qualitative approach to study climate anxiety and mental health could also further understanding.

4.1. Strengths and limitations

The primary strength of this review is the comprehensive literature searches across several multi-disciplinary journal databases. Additionally, our approach included the development of the field across a range of empirical methods, providing an overview of quantitative, mixed-method, qualitative and intervention studies. Intervention studies were sparse in the conventional literature, so for this topic only, we deemed it worthwhile to expand our search to include grey literature sources.

Our search strategy aimed to capture the prominent terms operationalised in the literature without returning a prohibitive number of results. This will not have been exhaustive as the emerging nature of literature on climate change and mental health means that terminology is being developed and adapted regularly. Our search strategy, and thus results, were broader than past reviews which targeted indirect impacts with a particular research focus. A limitation of our criteria is we may have excluded studies which found responses to eco/climate-anxiety as an emergent finding. Finally, while formally analysing the quality and risk of bias of the reported studies would be appropriate for a systematic review (Munn et al., 2018), this scoping review aimed to capture and summarises the breadth of empirical research methods developing the field and therefore conclusions made should be interpreted with caution. Future research could usefully provide a more critical analysis of the rigour and quality of the studies in this field.

4.2. Concluding remarks

We know that psychological responses to climate change and other related global environmental issues range from functional impairment to inspiring positive action to mitigate and adapt. Conclusions from our study are that rapid progress has been made to develop tools to measure climate/eco anxiety. Similarly, there has been progress on establishing a range of risk factors, and further research could usefully explore these to identify which are most relevant. As a relatively new phenomena largely dominated by quantitative cross-sectional research, more qualitative and mixed-method studies are needed to foster in-depth understanding of the distinctive nature of climate/eco-anxiety. Additionally, we identify a need for more longitudinal studies to improve our understandings of causes and effects, alongside more intervention studies, especially those that incorporate a validated before and after methodology. In-depth sequential mixed methods designs may provide the way forward to develop targeted interventions to reduce distress and increase positive action. Finally, we would call for more studies using samples from non-W.E.I.R.D. nations.

Declaration of competing interest

No conflicts of interest have been declared by the authors.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jenvp.2024.102326.

References

Agoston, C., Csaba, B., Nagy, B., Kvary, Z., Dull, A., Racz, J., et al. (2022). Identifying types of eco-anxiety, eco-guilt, eco-grief, and eco-coping in a climate-sensitive population: A qualitative study. *International Journal of Environmental Research and Public Health, 19*(4). https://doi.org/10.3390/ijerph19042461

Agoston, C., Urban, R., Nagy, B., Csaba, B., Kovary, Z., Kovacs, K., et al. (2022). The psychological consequences of the ecological crisis: Three new questionnaires to assess eco-anxiety, eco-guilt, and ecological grief. *Climate Risk Management, 37*, 19. https://doi.org/10.1016/j.crm.2022.100441

Arnout, B. A. (2023). An epidemiological study of mental health problems related to climate change: A procedural framework for mental health system workers. *Work, 75*(3), 813–835. https://doi.org/10.3233/WOR-220040

Aylward, B., Cunsolo, A., Vriezen, R., & Harper, S. L. (2022). Climate change is impacting mental health in North America: A systematic scoping review of the hazards, exposures, vulnerabilities, risks and responses. *International Review of Psychiatry, 34*(1), 34–50. https://doi.org/10.1080/09540261.2022.2029368

Baker, C., Clayton, S., & Bragg, E. (2021). Educating for resilience: Parent and teacher perceptions of children's emotional needs in response to climate change. *Environmental Education Research, 27*(5), 687–705. https://doi.org/10.1080/13504622.2020.1828288

Baudon, P., & Jachens, L. (2021). A scoping review of interventions for the treatment of eco-anxiety. *International Journal of Environmental Research and Public Health, 18*(18), 18. https://doi.org/10.3390/ijerph18189636

Berry, H. L., & Peel, D. (2015). Worrying about climate change: Is it responsible to promote public debate? *BJPsych International, 12*(2), 31–32. https://doi.org/10.1192/s2056474000000234

Bingley, W. J., Tran, A., Boyd, C. P., Gibson, K., Kalokerinos, E. K., Koval, P., et al. (2022). A multiple needs framework for climate change anxiety interventions. *American Psychologist, 77*(7), 812–821. https://doi.org/10.1037/amp0001012

Bright, M. L., & Eames, C. (2022). From apathy through anxiety to action: Emotions as motivators for youth climate strike leaders. *Australian Journal of Environmental Education, 38*(1), 13–25. https://doi.org/10.1017/aee.2021.22

Büchs, M., Hinton, E. D., & Smith, G. (2015). 'It helped me sort of face the end of the world': The role of emotions for third sector climate change engagement initiatives. *Environmental Values, 24*, 621–640.

Budziszewska, M., & Jonsson, S. E. (2021). From climate anxiety to climate action: An existential perspective on climate change concerns within psychotherapy. *Journal of Humanistic Psychology, 20*. https://doi.org/10.1177/0022167821993243

Budziszewska, M., & Jonsson, S. E. (2022). Talking about climate change and eco-anxiety in psychotherapy: A qualitative analysis of patients' experiences. *Psychotherapy, 11*. https://doi.org/10.1037/pst0000449

Chandler, E. J. (2023). *Addressing ecological anxiety: A scientifically informed, racially aware, spiritual intervention fuller theological seminary*. School of Psychology.

Chung, S. J., Jang, S. J., & Lee, H. (2023). Eco-anxiety and environmental sustainability interest: A secondary data analysis. *International Journal of Mental Health Nursing*. https://doi.org/10.1111/inm.13150

Cianconi, P., Betro, S., & Janiri, L. (2020). The impact of climate change on mental health: A systematic descriptive review. *Frontiers in Psychiatry, 11*, 15. https://doi.org/10.3389/fpsyt.2020.00074

Cianconi, P., Hanife, B., Grillo, F., Betro, S., Lesmana, C. B. J., & Janiri, L. (2023). Eco-emotions and psychoterratic syndromes: Reshaping mental health assessment under climate change. *Yale Journal of Biology & Medicine, 96*(2), 211–226. https://doi.org/10.59249/EARX2427

Clayton, S. (2020). Climate anxiety: Psychological responses to climate change. *Journal of Anxiety Disorders, 74*, 7. https://doi.org/10.1016/j.janxdis.2020.102263

Clayton, S., & Karazsia, B. T. (2020). Development and validation of a measure of climate change anxiety. *Journal of Environmental Psychology, 69*, 11. https://doi.org/10.1016/j.jenvp.2020.101434

Clayton, S., Pihkala, P., Wray, B., & Marks, E. (2023). Psychological and emotional responses to climate change among young people worldwide: Differences associated with gender, age, and country. *Sustainability, 15*(4). https://doi.org/10.3390/su15043540

Coffey, Y., Bhullar, N., Durkin, J., Islam, M. S., & Usher, K. (2021). Understanding eco-anxiety: A systematic scoping review of current literature and identified knowledge gaps. *The Journal of Climate Change and Health, 3*, Article 100047. https://doi.org/10.1016/j.joclim.2021.100047

Corvalan, C., Gray, B., on, Villalobos Prats, E., Sena, A., Hanna, F., & Campbell-Lendrum, D. (2022). Mental health and the global climate crisis. *Epidemiology and Psychiatric Sciences, 31*, e86. https://doi.org/10.1017/S2045796022000361

Cosgrove, M. R. (2022). *This place is a message: A case study examining the role of emotion, storytelling, and interactive performance art in climate change communication*. Yale University].

Crandon, T. J., Scott, J. G., Charlson, F. J., & Thomas, H. J. (2022). A social–ecological perspective on climate anxiety in children and adolescents. *Nature Climate Change, 12*(2), 123–131. https://doi.org/10.1038/s41558-021-01251-y

Cruz, S. M., & High, A. C. (2022). Psychometric properties of the climate change anxiety scale. *Journal of Environmental Psychology, 84*, 6. https://doi.org/10.1016/j.jenvp.2022.101905

Daeninck, C., Kioupi, V., & Vercammen, A. (2023). Climate anxiety, coping strategies and planning for the future in environmental degree students in the UK [Original Research]. *Frontiers in Psychology, 14*. https://doi.org/10.3389/fpsyg.2023.1126031

Ekholm, S., & Olofsson, A. (2017). Parenthood and worrying about climate change: The limitations of previous approaches. *Risk Analysis, 37*(2), 305–314. https://doi.org/10.1111/risa.12626

Eriksson, E., Peters, A.-K., Pargman, D., Hedin, B., Laurell-Thorslund, M., Sjoo, S., & ra. (2022). *Addressing students' eco-anxiety when teaching sustainability in higher education*. Bulgaria: Plovdiv.

Feather, G., & Williams, M. (2022). The moderating effects of psychological flexibility and psychological inflexibility on the relationship between climate concern and climate-related distress. *Journal of Contextual Behavioral Science, 23*, 137–143. https://doi.org/10.1016/j.jcbs.2021.12.007

Fyke, J., & Weaver, A. (2023). Reducing personal climate risk to reduce personal climate anxiety. *Nature Climate Change, 13*(3), 209–210. https://doi.org/10.1038/s41558-023-01617-4

Gago, T., & Sa, I. (2021). Environmental worry and wellbeing in young adult university students. *Current Research in Environmental Sustainability, 3*, 10. https://doi.org/10.1016/j.crsust.2021.100064

Gallay, E., Furlan Brighente, M., Flanagan, C., & Lowenstein, E. (2022). Place-based civic science-collective environmental action and solidarity for eco-resilience. *Child and Adolescent Mental Health, 27*(1), 39–46. https://doi.org/10.1111/camh.12537

Gawrych, M., & Holka-Pokorska, J. (2022). Mental health issues related to climate change in Poland - polish psychologists' and psychotherapists' perspective. *Archives of Psychiatry and Psychotherapy, 24*(2), 47–53. https://doi.org/10.12740/app/142826

Gillespie, S. (2013). Climate change and psyche: Conversations with and through dreams. *International Journal of Multiple Research Approaches, 7*(3), 343–354. https://doi.org/10.5172/mra.2013.7.3.343

Gunasiri, H., Wang, Y., Watkins, E.-M., Capetola, T., Henderson-Wilson, C., & Patrick, R. (2022). Hope, coping and eco-anxiety: Young people's mental health in a climate-impacted Australia. *International Journal of Environmental Research and Public Health, 19*(9). https://doi.org/10.3390/ijerph19095528

Hajek, A., & Konig, H.-H. (2022a). Climate anxiety in Germany. *Public Health, 212*, 89–94. https://doi.org/10.1016/j.puhe.2022.09.007

Hajek, A., & Konig, H.-H. (2022b). Climate anxiety, loneliness and perceived social isolation. *International Journal of Environmental Research and Public Health, 19*(22). https://doi.org/10.3390/ijerph192214991

Hajek, A., & Konig, H.-H. (2023). Do individuals with high climate anxiety believe that they will die earlier? First evidence from Germany. *International Journal of Environmental Research and Public Health, 20*(6). https://doi.org/10.3390/ijerph20065064

Head, L., & Harada, T. (2017). Keeping the heart a long way from the brain: The emotional labour of climate scientists. *Emotion, Space and Society, 24*, 34–41. https://doi.org/10.1016/j.emospa.2017.07.005

Heeren, A., Mouguiama-Daouda, C., & Contreras, A. (2022). On climate anxiety and the threat it may pose to daily life functioning and adaptation: A study among European and African French-speaking participants. *Climatic Change, 173*(1), 17. https://doi.org/10.1007/s10584-022-03402-2

Heeren, A., Mouguiama-Daouda, C., & McNally, R. J. (2023). A network approach to climate change anxiety and its key related features. *Journal of Anxiety Disorders*. https://doi.org/10.1016/j.janxdis.2022.102625

Hemsley, P. (2022). *Somatic learning and eco-anxiety in environmental education teacher preparation*. Western Washington University].

Hepp, J., Klein, S. A., Horsten, L. K., Urbild, J., & Lane, S. P. (2023). Introduction and behavioral validation of the climate change distress and impairment scale. *Scientific Reports, 13*(1), Article 11272. https://doi.org/10.1038/s41598-023-37573-4

Hickman, C., Marks, E., Pihkala, P., Clayton, S., Lew owski, R. E., Mayall, E. E., et al. (2021). Climate anxiety in children and young people and their beliefs about government responses to climate change: A global survey. *The Lancet Planetary Health, 5*(12), E863–E873. <Go to ISI>://WOS:000730800800010 https://www.sciencedirect.com/science/article/pii/S2542519621002783?via%3Dihub.

Hogg, T. L., Stanley, S. K., & O'Brien, L. V. (2023). Synthesising psychometric evidence for the climate anxiety scale and Hogg eco-anxiety scale. *Journal of Environmental Psychology, 88*, 10. https://doi.org/10.1016/j.jenvp.2023.102003

Hogg, T. L., Stanley, S. K., O'Brien, L. V., Wilson, M. S., & Watsford, C. R. (2021). The Hogg eco-anxiety scale: Development and validation of a multidimensional scale. *Global Environmental Change-Human and Policy Dimensions, 71*, 10. https://doi.org/10.1016/j.gloenvcha.2021.102391

Humby, R. (2023). *The eco-existential threatometer: A pedagogical approach to eco-anxieties*. Queen's University].

Innocenti, M., Santarelli, G., Faggi, V., Castellini, G., Manelli, I., Magrini, G., et al. (2021). Psychometric properties of the Italian version of the climate change anxiety scale. *The Journal of Climate Change and Health, 3*, Article 100080. https://doi.org/10.1016/j.joclim.2021.100080

Innocenti, M., Santarelli, G., Lombardi, G. S., Ciabini, L., Zjalic, D., Di Russo, M., et al. (2023). How can climate change anxiety induce both pro-environmental behaviours and eco-paralysis? The mediating role of general self-efficacy. *International Journal of Environmental Research and Public Health, 20*(4). https://doi.org/10.3390/ijerph20043085

Jang, S. J., Chung, S. J., & Lee, H. (2023). Validation of the climate change anxiety scale for Korean adults. *Perspectives in Psychiatric Care, 2023*, 8. https://doi.org/10.1155/2023/9718834

Keene, C. (2023). *Scuba diving immersion Intervention for Adolescents with climate change anxiety Saint Mary's college of California]*.

Kleres, J., & Wettergren, Å. (2017). Fear, hope, anger, and guilt in climate activism. *Social Movement Studies, 16*(5), 507–519. https://doi.org/10.1080/14742837.2017.1344546

Klingelhöfer, D., Braun, M., Brüggmann, D., & Groneberg, D. A. (2023). Heatwaves: Does global research reflect the growing threat in the light of climate change? *Globalization and Health, 19*(1), 56.

Kurth, C., & Pihkala, P. (2022). Eco-anxiety: What it is and why it matters. *Frontiers in Psychology, 13*, 13. https://doi.org/10.3389/fpsyg.2022.981814

Larionow, P., Soltys, M., Izdebski, P., Mudlo-Glagolska, K., Golonka, J., Demski, M., et al. (2022). Climate change anxiety assessment: The psychometric properties of the polish version of the climate anxiety scale. *Frontiers in Psychology, 13*, 9. https://doi.org/10.3389/fpsyg.2022.870392

Latkin, C., Dayton, L., Scherkoske, M., Countess, K., & Thrul, J. (2022). What predicts climate change activism?: An examination of how depressive symptoms, climate change distress, and social norms are associated with climate change activism. *The Journal of Climate Change and Health, 8*. https://doi.org/10.1016/j.joclim.2022.100146

Lee, H., Calvin, K., Dasgupta, D., Krinner, G., Mukherji, A., Thorne, P., et al. (2023). IPCC, 2023: Climate change 2023: Synthesis report, summary for policymakers. Contribution of working groups I. In H. Lee, & J. Romero (Eds.), *II and III to the sixth assessment report of the intergovernmental panel on climate change [core writing team*. Geneva, Switzerland: IPCC.

Léger-Goodes, T., Malboeuf-Hurtubise, C., Hurtubise, K., Simons, K., Boucher, A., Paradis, P.-O., et al. (2023). How children make sense of climate change: A descriptive qualitative study of eco-anxiety in parent-child dyads. *PLoS One, 18*(4), Article e0284774. https://doi.org/10.1371/journal.pone.0284774

Léger-Goodes, T., Malboeuf-Hurtubise, C., Mastine, T., Généreux, M., Paradis, P.-O., & Camden, C. (2022). Eco-anxiety in children: A scoping review of the mental health impacts of the awareness of climate change. *Frontiers in Psychology, 13*, Article 872544. https://doi.org/10.3389/fpsyg.2022.872544

Lehtonen, A., & Pihkala, P. (2021). Encounters with climate change and its psychosocial aspects through performance making among young people. *Environmental Education Research, 27*(5), 743–761. https://doi.org/10.1080/13504622.2021.1923663

Leonhardt, M., Granrud, M. D., Bonsaksen, T., & Lien, L. (2022). Associations between mental health, lifestyle factors and worries about climate change in Norwegian adolescents. *International Journal of Environmental Research and Public Health, 19*(19), 12. https://doi.org/10.3390/ijerph191912826

Loll, L., Schmatz, N., von Lonski, L., Cremer, L. D., & Richter, M. H. (2023). The influence of climate crisis-related media reporting on the eco-anxiety of individuals. *Interdisciplinary Journal of Environmental and Science Education, 19*(2), Article e2306.

Lukacs, J. N., Bratu, A., Adams, S., Logie, C., Tok, N., McCunn, L. J., et al. (2023). The concerned steward effect: Exploring the relationship between climate anxiety, psychological distress, and self-reported climate related behavioural engagement. *Journal of Environmental Psychology, 90*, Article 102091. https://doi.org/10.1016/j.jenvp.2023.102091

Lutz, P. K., Passmore, H. A., Howell, A. J., Zelenski, J. M., Yang, Y., & Richardson, M. (2023). The continuum of eco-anxiety responses: A preliminary investigation of its nomological network. *Collabra-Psychology, 9*(1), 20. https://doi.org/10.1525/collabra.67838

Ma, T., Moore, J., & Cleary, A. (2022). Climate change impacts on the mental health and wellbeing of young people: A scoping review of risk and protective factors. *Social Science & Medicine, 301*, 1–14. https://doi.org/10.1016/j.socscimed.2022.114888

MacKay, M., Parlee, B., & Karsgaard, C. (2020). Youth engagement in climate change action: Case study on indigenous youth at COP24. *Sustainability, 12*(16), 17. https://doi.org/10.3390/su12166299

Maran, D. A., & Begotti, T. (2021). Media exposure to climate change, anxiety, and efficacy beliefs in a sample of Italian university students. *International Journal of Environmental Research and Public Health, 18*(17), 11. https://doi.org/10.3390/ijerph18179358

Marczak, M., Winkowska, M., Chaton-Østlie, K., Morote Rios, R., & Klöckner, C. A. (2023). 'When I say i`m depressed, it's like anger' an exploration of the emotional landscape of climate change concern in Norway and its psychological, social and political implications. *Emotion, Space and Society, 46*, 1–8. https://doi.org/10.1016/j.emospa.2023.100939

Marks, E., Atkins, E., Garrett, J. K., Abrams, J. F., Shackleton, D., Hennessy, L., et al. (2023). Stories of hope created together: A pilot, school-based workshop for sharing eco-emotions and creating an actively hopeful vision of the future. *Frontiers in Psychology, 13*, 13. https://doi.org/10.3389/fpsyg.2022.1076322

Martin, G., Reilly, K., Everitt, H., & Gillil, J. A. (2021). Review: The impact of climate change awareness on children's mental well-being and negative emotions – a scoping review. *Child and Adolescent Mental Health.* https://doi.org/10.1111/camh.12525

Mathers-Jones, J., & Todd, J. (2023). Ecological anxiety and pro-environmental behaviour: The role of attention. *Journal of Anxiety Disorders, 98*, Article 102745. https://doi.org/10.1016/j.janxdis.2023.102745

Matthews, V., Longman, J., Berry, H. L., Passey, M., Bennett-Levy, J., Morgan, G. G., et al. (2019). *Differential mental health impact six months after extensive river flooding in rural Australia: A cross-sectional analysis through an equity lens* (2296-2565 (Print)).

McBride, S. E., Hammond, M. D., Sibley, C. G., & Milfont, T. L. (2021). Longitudinal relations between climate change concern and psychological wellbeing. *Journal of Environmental Psychology, 78*, 5. https://doi.org/10.1016/j.jenvp.2021.101713

Morrison, L., Muller, I., Yardley, L., & Bradbury, K. (2018). The person-based approach to planning, optimising, evaluating and implementing behavioural health interventions. *The European Health Psychologist, 20*(3), 464–469.

Mouguiama-Daouda, C., Blanchard, M. A., Coussement, C., & Heeren, A. (2022). On the measurement of climate change anxiety: French validation of the climate anxiety scale. *Psychologica Belgica, 62*(1), 123–135. https://doi.org/10.5334/pb.1137

Munn, Z., Peters, M., Stern, C., Tufanaru, C., McArthur, A., & Aromataris, E. (2018). Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC Medical Research Methodology, 18*(1). https://doi.org/10.1186/s12874-018-0611-x

Nasa, P., Jain, R., & Juneja, D. (2021). Delphi methodology in healthcare research: How to decide its appropriateness. *World Journal of Methodology, 11*(4), 116.

Nielsen, M., Haun, D., Kärtner, J., & Legare, C. H. (2017). The persistent sampling bias in developmental psychology: A call to action. *Journal of Experimental Child Psychology, 162*, 31–38. https://doi.org/10.1016/j.jecp.2017.04.017

Noy, S., Patrick, R., Capetola, T., Henderson-Wilson, C., Chin, J. W., & LaMontagne, A. (2022). Minding environment, minding workers: Environmental workers' mental health and wellbeing. *Global Health Promotion, 29*(4), 8–17. https://doi.org/10.1177/17579759221081881

Ogunbode, C. A., Doran, R., Hanss, D., Ojala, M., Salmela-Aro, K., van den Broek, K. L., et al. (2022). Climate anxiety, wellbeing and pro-environmental action: Correlates of negative emotional responses to climate change in 32 countries. *Journal of Environmental Psychology, 84*, 14. https://doi.org/10.1016/j.jenvp.2022.101887

Ogunbode, C. A., Pallesen, S., Böhm, G., Doran, R., Bhullar, N., Aquino, S., et al. (2021). Negative emotions about climate change are related to insomnia symptoms and mental health: Cross-sectional evidence from 25 countries. *Current Psychology: A Journal for Diverse Perspectives on Diverse Psychological Issues.* https://doi.org/10.1007/s12144-021-01385-4

Ojala, M. (2012a). How do children cope with global climate change? Coping strategies, engagement, and well-being. *Journal of Environmental Psychology, 32*(3), 225–233. https://doi.org/10.1016/j.jenvp.2012.02.004

Ojala, M. (2012b). Regulating worry, promoting hope: How do children, adolescents, and young adults cope with climate change? *International Journal of Environmental & Science Education, 7*(4), 537–561. https://search.ebscohost.com/login.aspx?direct=true&db=psyh&AN=2013-21828-003&site=ehost-livemaria.ojala@edu.uu.se.

Ojala, M. (2013). Coping with climate change among adolescents: Implications for subjective well-being and environmental engagement. *Sustainability, 5*(5), 2191–2209. https://doi.org/10.3390/su5052191

Parry, S., McCarthy, S. R., & Clark, J. (2021). Young people's engagement with climate change issues through digital media – a content analysis. *Child and Adolescent Mental Health.* https://doi.org/10.1111/camh.12532

Pavani, J.-B., Nicolas, L., & Bonetto, E. (2023). Eco-anxiety motivates pro-environmental behaviors: A two-wave longitudinal study. *Motivation and Emotion.* https://doi.org/10.1007/s11031-023-10038-x

Peters, M. D., Marnie, C., Colquhoun, H., Garritty, C. M., Hempel, S., Horsley, T., et al. (2021). Scoping reviews: Reinforcing and advancing the methodology and application. *Systematic Reviews, 10*(1), 1–6.

Pihkala, P. (2020). Anxiety and the ecological crisis: An analysis of eco-anxiety and climate anxiety. *Sustainability, 12*(19), 20. https://doi.org/10.3390/su12197836

Pihkala, P. (2022a). The process of eco-anxiety and ecological grief: A narrative review and a new proposal. *Sustainability, 14*(24), 53. https://doi.org/10.3390/su142416628

Pihkala, P. (2022b). Toward a taxonomy of climate emotions. *Frontiers in Climate, 3*, 22. https://doi.org/10.3389/fclim.2021.738154

Pirkle, L. T., Jennings, N., Vercammen, A., & Lawrance, E. L. (2022). Current understanding of the impact of climate change on mental health within UK parliament. *Frontiers in Public Health, 10*, 13. https://doi.org/10.3389/fpubh.2022.913857

Pollock, D., Peters, M. D. J., Khalil, H., McInerney, P., Alexander, L., Tricco, A. C., et al. (2023). *Recommendations for the extraction, analysis, and presentation of results in scoping reviews* (2689-8381 (Electronic)).

Raile, P. (2023). Poetry therapy and Eco-Anxiety - a case study. *Journal of Poetry Therapy, 14*. https://doi.org/10.1080/08893675.2023.2203833

Raker, E. J., Lowe, S. R., Arcaya, M. C., Johnson, S. T., Rhodes, J., & Waters, M. C. (2019). Twelve years later: The long-term mental health consequences of Hurricane Katrina. *Social Science & Medicine, 242*, Article 112610.

Ramadan, R., ell, A., Lavoie, S., Gao, C. X., Manrique, P. C., Anderson, R., et al. (2023). Empirical evidence for climate concerns, negative emotions and climate-related mental ill-health in young people: A scoping review. *Early Intervention in Psychiatry, 17*(6), 537–563. https://doi.org/10.1111/eip.13374

Ramirez-Lopez, A. S., Rosetti, M. F., & Poma, A. (2023). Gender, exposure to news, knowledge about climate change, and prosociality predict climate anxiety scores in Mexican students. *Ecopsychology, 15*(2), 184–192. https://doi.org/10.1089/eco.2022.0049

Rehling, J. T. C. (2022). Conceptualising eco-anxiety using an existential framework. *South African Journal of Psychology, 52*(4), 472–485. https://doi.org/10.1177/00812463221130898

Reser, J. P., Bradley, G. L., & Ellul, M. C. (2012). Public risk perceptions, understandings and responses to climate change. In *Applied studies in climate adaptation* (pp. 43–50). https://doi.org/10.1002/9781118845028.ch6

Reyes, M. E. S., Carmen, B. P. B., Luminarias, M. E. P., Mangulabnan, S., & Ogunbode, C. A. (2023). An investigation into the relationship between climate change anxiety and mental health among Gen Z Filipinos. *Current Psychology, 42*(9), 7448–7456. https://doi.org/10.1007/s12144-021-02099-3

Sampaio, F., & Sequeira, C. (2022). Climate anxiety: Trigger or threat for mental disorders? *The Lancet Planetary Health, 6*(2), e89. https://doi.org/10.1016/S2542-5196(22)00008-0

Sangervo, J., Jylha, K. M., & Pihkala, P. (2022). Climate anxiety: Conceptual considerations, and connections with climate hope and action. *Global Environmental Change-Human and Policy Dimensions, 76*, 11. https://doi.org/10.1016/j.gloenvcha.2022.102569

Sarrasin, O., Henry, J. L. A., Masserey, C., & Graff, F. (2022). The relationships between adolescents' climate anxiety, efficacy beliefs, group dynamics, and pro-environmental behavioral intentions after a group-based environmental education intervention. *Youth, 2*(3), 422–440. https://www.mdpi.com/2673-995X/2/3/31.

Schwaab, L., Gebhardt, N., Friederich, H.-C., & Nikendei, C. (2022). Climate change related depression, anxiety and stress symptoms perceived by medical students. *International Journal of Environmental Research and Public Health, 19*(15). https://doi.org/10.3390/ijerph19159142

Schwartz, S. E. O., Benoit, L., Clayton, S., Parnes, M. F., Swenson, L., & Lowe, S. R. (2022). Climate change anxiety and mental health: Environmental activism as buffer. *Current Psychology, 14.* https://doi.org/10.1007/s12144-022-02735-6

Sciberras, E., & Fernando, J. W. (2021). Climate change-related worry among Australian adolescents: An eight-year longitudinal study. *Child and Adolescent Mental Health.* https://doi.org/10.1111/camh.12521

Seaman, E. B. (2016). *Climate change on the therapist's couch : How mental health clinicians receive and respond to indirect psychological impacts of climate change in the therapeutic setting smith college].*

Searle, K., & Gow, K. (2010). Do concerns about climate change lead to distress? *International Journal of Climate Change Strategies and Management, 2*(4), 362–379. https://doi.org/10.1108/17568691011089891

Silva, J. F. B., & Coburn, J. (2023). Therapists' experience of climate change: A dialectic between personal and professional. *Counselling and Psychotherapy Research, 23*(2), 417–431. https://doi.org/10.1002/capr.12515

Simon, P. D., Pakingan, K. A., & Aruta, J. (2022). Measurement of climate change anxiety and its mediating effect between experience of climate change and mitigation actions of Filipino youth. *Educational and Developmental Psychologist, 39*(1), 17–27. https://doi.org/10.1080/20590776.2022.2037390

Soutar, C., & Wand, A. P. F. (2022). Understanding the spectrum of anxiety responses to climate change: A systematic review of the qualitative literature. *International Journal of Environmental Research and Public Health, 19*(2), 23. https://doi.org/10.3390/ijerph19020990

Stevenson, K., & Peterson, N. (2016). Motivating action through fostering climate change hope and concern and avoiding despair among adolescents. *Sustainability, 8*(1), 6. https://www.mdpi.com/2071-1050/8/1/6.

Stewart, A. E. (2021). Psychometric properties of the climate change worry scale. *International Journal of Environmental Research and Public Health, 18*(2), 22. https://doi.org/10.3390/ijerph18020494

Takshe, A. A., Hashi, Z., Mohammed, M., & Astari, A. (2022). Eco-anxiety: A Q method analysis towards eco-anxiety attitudes in the United Arab Emirates. *Journal of Social Work Practice, 13.* https://doi.org/10.1080/02650533.2022.2137120

Tam, K. P., Chan, H. W., & Clayton, S. (2023). Climate change anxiety in China, India, Japan, and the United States. *Journal of Environmental Psychology, 87*, 14. https://doi.org/10.1016/j.jenvp.2023.101991

Temte, J. L., Holzhauer, J. R., & Kushner, K. P. (2019). *Correlation between climate change and dysphoria in primary care* (Vol. 118, pp. 71–74). WMJ : official publication of the State Medical Society of Wisconsin (2).

Thomas, I., Martin, A., Wicker, A., & Benoit, L. (2022). Understanding youths' concerns about climate change: A binational qualitative study of ecological burden and

resilience. *Child and Adolescent Psychiatry and Mental Health, 16*(1), 13. https://doi.org/10.1186/s13034-022-00551-1

Tricco, A., Lillie, E., Zarin, W., O'Brien, K., Colquhoun, H., Levac, D., et al. (2018). PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. *Annals of Internal Medicine, 169*(7), 467–473. https://doi.org/10.7326/m18-0850%m30178033

Trott, C. D. (2022). Climate change education for transformation: Exploring the affective and attitudinal dimensions of children's learning and action. *Environmental Education Research, 28*(7), 1023–1042. https://doi.org/10.1080/13504622.2021.2007223

Uzun, K., Öztürk, A. F., Karaman, M., Altin, M. O., Cebecï, F., Arici, A., et al. (2022). Adaptation of the eco-anxiety scale to Turkish: A validity and reliability study. *cal. 14*, 15.

Van de Vuurst, P., & Escobar, L. E. (2023). Climate change and infectious disease: A review of evidence and research trends. *Infectious Diseases of Poverty, 12*(1), 51.

Vercammen, A., Oswald, T., & Lawrance, E. (2023). Psycho-social factors associated with climate distress, hope and behavioural intentions in young UK residents. *PLOS Global Public Health, 3*(8), Article e0001938. https://doi.org/10.1371/journal.pgph.0001938

Verplanken, B., Marks, E., & Dobromir, A. I. (2020). On the nature of eco-anxiety: How constructive or unconstructive is habitual worry about global warming? *Journal of Environmental Psychology, 72*, 11. https://doi.org/10.1016/j.jenvp.2020.101528

Walinski, A., er, J., Gerlinger, G., Clemens, V., Meyer-Lindenberg, A., & Heinz, A. (2023). The effects of climate change on mental health. *Deutsches Arzteblatt International, 120* (8), 117. https://doi.org/10.3238/arztebl.m2022.0403

Whitmarsh, L., Player, L., Jiongco, A., James, M., Williams, M., Marks, E., et al. (2022). Climate anxiety: What predicts it and how is it related to climate action? *Journal of Environmental Psychology, 83*, 10. https://doi.org/10.1016/j.jenvp.2022.101866

Wong, C. W., & Carlson, C. H. (2020). Resilience within and resilience without: Mindfulness and sustainability programming using an embedded engineering librarian approach. *Asee's virtual conference.* Paper ID #30504.

Wortzel, J. D., Champlin, L. K., Wortzel, J. R., Lewis, J., Haase, E., & Mark, B. (2022). Reframing climate change: Using children's literature as a residency training tool to address climate anxiety and model innovation. *Academic Psychiatry, 46*(5), 584–585. https://doi.org/10.1007/s40596-022-01651-y

Wu, J., Long, D., Hafez, N., Maloney, J., Lim, Y., & Samji, H. (2023). Development and validation of a youth climate anxiety scale for the Youth Development Instrument survey. *International Journal of Mental Health Nursing.* https://doi.org/10.1111/inm.13201. *n/a*(n/a).

Wullenkord, M. C., Troger, J., Hamann, K. R. S., Loy, L. S., & Reese, G. (2021). Anxiety and climate change: A validation of the climate anxiety scale in a German-speaking quota sample and an investigation of psychological correlates. *Climatic Change, 168* (3), 23. https://doi.org/10.1007/s10584-021-03234-6

Zacher, H., & Rudolph, C. W. (2023). Environmental knowledge is inversely associated with climate change anxiety. *Climatic Change, 176*(4), 9. https://doi.org/10.1007/s10584-023-03518-z

Zaremba, D., Kulesza, M., Herman, A. M., Marczak, M., Kossowski, B., Budziszewska, M., et al. (2022). A wise person plants a tree a day before the end of the world: Coping with the emotional experience of climate change in Poland. *Current Psychology, 19*. https://doi.org/10.1007/s12144-022-03807-3

Zhou, Y. (2019). A mixed methods model of scale development and validation analysis. *Measurement: Interdisciplinary Research and Perspectives, 17*(1), 38–47.