A Conceptual and Psychometric Examination of Climate Anxiety

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Abstract

Climate change stands as one of the most pressing crises threatening the world today, affecting natural environments, community resources and functioning, and individual's health. As this crisis worsens, people are increasingly reporting experiencing negative affective reactions to climate change, even when they have not themselves been directly impacted by it. These various reactions, described under the umbrella term of "climate anxiety", have been the focus of numerous studies, but the lack of a consistent definition and theory of climate anxiety has hindered scholars' ability to integrate and build on the knowledge gained from these studies. My aim with this thesis is to contribute to this integration effort by articulating the various contributions from other scholars into a cohesive and holistic conceptualization of climate anxiety, and to examine how prevalent and adaptive this phenomenon is. Thus, the first study in my thesis (Chapter 3) is a meta-analysis of 25 studies examining the link between climate anxiety and psychological wellbeing. In this study, we found there was a strong association between these variables, whereby higher levels of climate anxiety were associated with lower levels of wellbeing. Given the consistent association between climate anxiety and psychological illbeing, in the next study (Chapter 4), we found that measures of climate anxiety capture this phenomenon differently to how measures of domain-free psychopathology capture their respective target constructs, by focusing more on affective reactions and less on somatic complaints. Additionally, we also found evidence supporting the convergence of the different climate anxiety measures, indicating they could be capturing the same underlying trait, and raising questions about the lack of parsimony in climate anxiety measuring. To address these concerns, in Chapter 5, we report a mixed-methods study where we developed a condensed climate anxiety measure with a wider representation of the various features associated with climate anxiety using Rasch modelling. Despite its wider content representation and ability to differentiate between high levels of climate anxiety, our measure did not predict wellbeing outcomes better than an existing eco-anxiety measure. Therefore, for the next study (Chapter 6), we used an established measure of climate anxiety to assess the prevalence of climate anxiety in New Zealand, finding that 1 in 20 New Zealanders report experiencing these affective reactions. Furthermore, we found that people who have been directly impacted by climate change, people with environment-dependent jobs, and those who did not feel prepared to handle climate change reported higher levels of climate anxiety. Lastly, we found that those with higher levels of climate anxiety also reported higher psychological distress and more engagement in pro-environmental behaviours. Altogether, this thesis contributes to the climate anxiety literature by providing a framework for the assessment of the various dimensions of climate anxiety and how they may be contributing do individual and planetary wellbeing. Moreover, the findings here may be used to raise awareness for the potential benefits and impairment associated with climate anxiety, and justify support for groups at increased risk of maladaptive climate anxiety.

Keywords: climate change, climate anxiety, prevalence, questionnaires, pro-environmental behaviour, wellbeing

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Conference Presentations:

Gago, T., Sargisson, R. J., & Milfont, T. L. (2023, October 19-20). A meta-analysis on the relationship between climate anxiety and wellbeing [Paper presentation]. APA Division 34 2023 Virtual Conference.

Gago, T., Sargisson, R. J., & Milfont, T. L. (2023, November 9). A meta-analysis on the relationship between climate anxiety and wellbeing [Paper presentation]. 2023 ALPSS Postgraduate Conference, Hamilton, New Zealand.

Gago, T., Sargisson, R. J., & Milfont, T. L. (2023, November 23-26). A meta-analysis on the relationship between climate anxiety and wellbeing [Paper presentation]. SASP-ACPID 2023 Conference, Noosa, QLD, Australia. https://sasp.org.au/events/conference/sasp-2023-conference/

Chapter 4

Gago, T., Sargisson, R. J., & Milfont, T. L. (2025, August 20). Examining Content Representation and Convergence of Climate Anxiety Measures. https://doi.org/10.31234/osf.io/deqt4_v1

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Gago, T., Sargisson, R. J., & Milfont, T. L. (2024, October 17-18). Climate Anxiety [Paper presentation]. 2024 Postgraduate Conference, Hamilton, New Zealand. https://www.waikato.ac.nz/news-events/events/find-event/2024-postgraduate-conference/

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Gago, T., Sargisson, R. J., & Milfont, T. L. (2026, February 19). Prevalence and Nomological Network of Climate Anxiety in a Representative New Zealand Sample. https://doi.org/10.31234/osf.io/vh9ux_v1

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Gago, T., Sargisson, R. J., & Milfont, T. L. (2025, June 15-18). Prevalence and Nomological Network of Climate Anxiety in a Representative New Zealand Sample. In Klebl, C. (Chair), *Climate Change 2* [Symposium]. SASP-ACPID 2025 Conference, Melbourne,

VIC, Australia. https://sasp.org.au/events/conference/sasp-acpid-2025-conference/sasp-acpid-2025-program/

Chapter 1

> Greenhouse gas emissions keep growing. Global temperatures keep rising. And our planet is fast approaching tipping points that will make climate chaos irreversible. We are on a highway to climate hell with our foot on the accelerator.
>
> –António Manuel de Oliveira Guterres, *Secretary-General's remarks to High-Level opening of COP27*

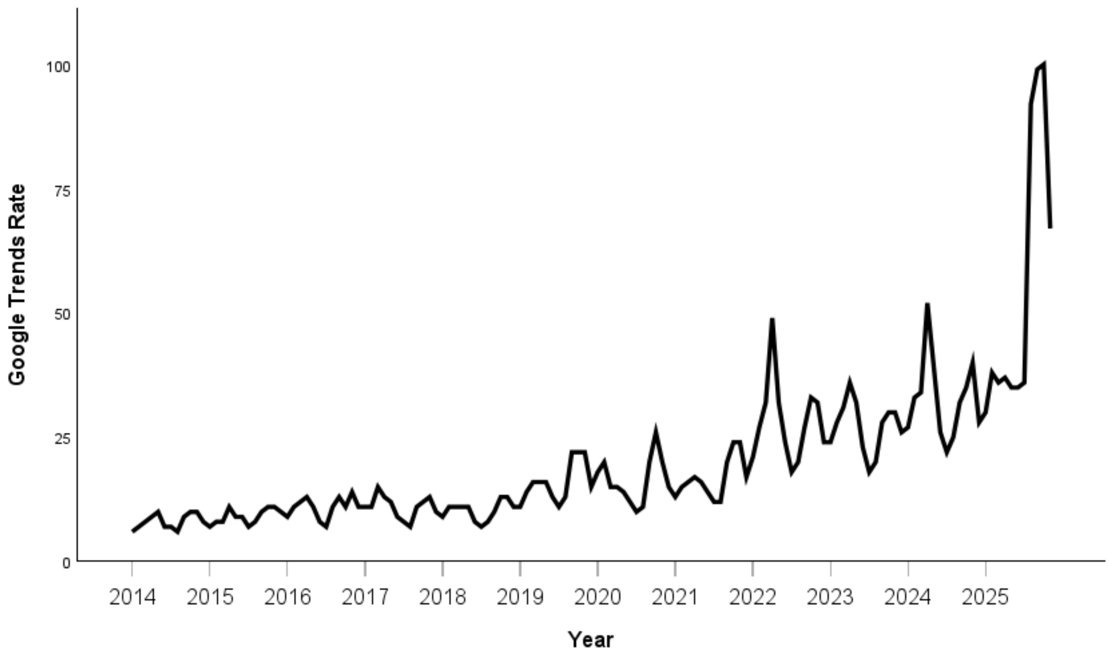
With the climate crisis evolving with no resolution in sight, people are faced with the challenging understanding that humanity may not achieve the goals set to prevent further planetary deterioration (Romanello et al., 2025). As the above quote from the UN Secretary General António Guterres illustrates, there is a prevailing sense of impending environmental doom and an urgency to act that has hardly been heeded. Anthropogenic climate change, understood as the human-driven long-term shifts in temperature and weather patterns resulting in global warming, extreme weather events, and declining biodiversity (United Nations [UN], n.d.-c), is but one of the various interconnected global crises contributing to this urgency, together with the human health crisis, ongoing wars, the rise of fascism, economic instability, and other forms of environmental degradation like resource depletion and waste management. Termed the polycrisis (Tooze, 2022), these multiple, interdependent emergencies amplify each other and generate other critical problems, leading to worse outcomes for humanity (M. Lawrence et al., 2024). In their systematic literature review, Rakowski et al. (2025) identified climate change as the most frequently mentioned crisis, highlighting the salience of this particular problem in the wider context of the polycrisis, and the importance of finding solutions to improve humanity's chances of achieving prosperity.

It is not just in the realm of academia that climate change is recognized as an urgent crisis. The UN identifies climate change as "the defining issue of our time" (UN, n.d-b.) and organizes yearly climate change conferences, the Conference of the Parties (COPs), with the ultimate goal of mitigating further climate change (UN, n.d.-a). It is also a threat increasingly recognized by the general population. Cross-national surveys from 2015 indicated people in 19 out of 40 surveyed nations listed climate change as their top concern, with people from Latin America and Africa reporting the highest levels of concern (Pew Research Center, 2015a, 2015b). More recent global surveys found 78% of participants felt the world was headed towards environmental disaster (Ipsos, 2025), and people placed climate change on par with poverty and inequality as the main challenges the world is facing (Peiris & Samarasinghe, 2023). Accordingly, a separate study found people in 80% of surveyed countries were more worried about climate change than in the previous year, with the highest increases in worry observed in Latin America and the Caribbean, Central and North Africa, Southern Europe, and Central, South, and Southeast Asia (Flynn et al., 2024).

Perhaps consequently, Google Trends data from 2014 to 2024 show a rise in searches for "climate change health", indicating an increase in information-seeking behaviour from people about the health implications of climate change that surpassed a more general search for just "climate change" (Dasandi et al., 2025). This trend was particularly noticeable in low and middle-income countries, such as Samoa, Fiji, and Malawi, which suggests an increased interest in these topics from people living in areas of the world who are experiencing the brunt of climate change (Dasandi et al., 2025; Intergovernmental Panel on Climate Change [IPCC], 2023). Expanding on Dasandi et al.'s (2025) findings, Figure 1.1 shows that searches for "climate change health" have increased even more in 2025, hitting a peak between August and October that almost doubled the highest rate of searches observed in 2024. This coincided with summer in heatwaves and wildfires in the Northern Hemisphere (e.g., Jackson et al., 2025; Luna & Fernandes, 2025) and the release of reports on the impacts of climate change on health from the World Meteorological Organization (WMO, 2025) and the Lancet (Romanello et al., 2025).

Figure 1.1

Google Trends Search Rates for "Climate Change Health" from January 2014 to December 2025



Note. The Google Trends data used to create this graph was collected on December 1st, 2025, and did not include the result for that month.

Taken together, it is evident that climate change is an important issue for academics, international institutions, and the general public, and there is a growing concern about how it is impacting health as the climate crisis develops. To contextualize this concern, in the following section I[1] will outline the observed and projected climate

[1] Throughout this thesis, the first-person singular ("I", referring to myself, Tomás Gago) is used in the non-empirical chapters, and the first-person plural ("we", referring to myself, and my two supervisors, Rebecca J. Sargisson and Taciano L. Milfont) in the empirical chapters. This is

change impacts around the world, followed by how these changes may impact people's health, with a particular focus on mental health.

Climate Change Impacts and Projections

Reports from different climate-related organizations detail the impacts climate change is currently having on the planet, as well as how they are projected to evolve in the following decades. The global surface temperature has increased 1.42 ºC compared to the average temperature in the pre-industrial era (WMO, 2025), with the last 11 years (2015-2025) being the warmest years on record, and the overall number of extremely hot days steadily increasing. Because of climate change, people have experienced 530% more heatwave days than expected without climate change, and 79% of countries globally experienced at least 10 heatwave days in the period between 2020 and 2024, with Small Island Developing States (SIDS), Africa, and Asia as the regions with the biggest exposure to this extreme weather (Romanello et al., 2025). Similarly, ocean temperatures have warmed at considerable rates, limiting the planet's ability to remove carbon from the atmosphere, which is threatening the survivability of critical maritime ecosystems and intensifying other climate impacts like tropical and sub-tropical storms and cyclones, melting of sea-ice, and rise in sea levels (WMO, 2025).

Additionally, different parts of the world will experience changes in precipitation, leading to more very dry and very wet weather. Places such as the Mediterranean, Middle East, South America, Australia, Canada, and West and Southern Africa, will be experiencing drier conditions and more frequent and long-lasting drought periods (IPCC, 2021, 2023; WMO, 2025). Combined with the warmer temperatures, these arid environments will be at an increased risk of wildfires. Conversely, other areas, like Central

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done to acknowledge my co-authors' contributions in the pieces that have already been published or are being submitted for publication.

Africa, North and Central Europe, and large parts of Asia, are likely to experience increases in heavy precipitation and resulting flooding (IPCC, 2021, 2023; WMO, 2025). These various extreme weather events (i.e., storms, cyclones, flooding, droughts, and heatwaves) are likely to become more frequent and destructive, and co-occur in the same regions, amplifying their destructive power (Clayton et al., 2021; IPCC, 2023).

The impacts climate change has on the natural environment also carry indirect social implications, further compounding the polycrisis. Rising temperatures, alongside sea-level rise and flooding can damage necessary infrastructures, including transportation, sanitation, and energy production, particularly in low-lying and coastal areas as well as mountainous regions (IPCC, 2023). Furthermore, food and water security are threatened by the changes in temperature, precipitation, and the occurrence of extreme weather events (IPCC, 2023), particularly in middle and low-latitude regions. The impacts of climate and weather extremes are expected to worsen in the upcoming years, and these impacts have already contributed to the displacement of populations in Africa, Asia, North America, and SIDS in the Caribbean and South Pacific (IPCC, 2023). The cascading natural and social impacts of climate change, coupled with other ongoing crises, will likely worsen economic instability across the world, particularly in lower and middle-income countries (IPCC, 2023; Romanello et al., 2025). It is important to recognize that the people least responsible for the climate crisis, meaning the socially disadvantaged and vulnerable (e.g., developing nations, lower socioeconomic status people, minorities and Indigenous Peoples), are the ones most exposed to its impacts (Cianconi et al., 2020; Clayton & Crandon, 2025; IPCC, 2023), making climate change not just an environmental crisis, but a social justice crisis.

Impacts on Health

Given the vast impacts of climate change on multiple natural and human systems, it is unsurprising that climate change carries significant implications for people’s physical, community, and mental health. It can cause injuries and deaths, damage physical and social environments, and trigger negative emotions that people can struggle with in the long-term (Berry et al., 2010). The impacts of climate change on these three dimensions of health can occur during or in the aftermath of acute or subacute extreme weather events. Acute extreme weather events, such as storms, wildfires, or flooding, happen at a particular point in time and have a fast onset and great destructive potential, whereas subacute prolonged weather events, like droughts or heatwaves, happen across a period of months or years and have more insidious consequences, especially when these changes permanently alter the environment, for example by leading to the erosion of soils or the loss of biodiversity (Bourque & Cunsolo Willox, 2014; Clayton & Crandon, 2025; Palinkas & Wong, 2020; Thoma et al., 2021). For each of these types of events, the impacts of climate change on health can happen through direct, indirect, or vicarious pathways, and often involve a combination of the three (Thoma et al., 2021). Likewise, these pathways can overlap or be nested in each other (Middleton et al., 2020; Thoma et al., 2021). That is, the same weather event can trigger direct and indirect impacts, or indirect impacts can happen as a result of direct impacts; for example, extreme floods can result in direct impacts such as deaths, as well as indirect impacts such as displacements and the destruction of cropland, as seen in the Democratic Republic of Congo and Nigeria in 2025 (WMO, 2025). In the next paragraphs, I will provide examples of direct and indirect health impacts for both acute and subacute weather events, followed by how climate change can impact health even without any personal experience of these changes.

Direct Effects. The direct effects of climate change on health include the immediate harms as a result of exposure to weather phenomena associated with climate change (Charlson, Ali, Benmarhnia, et al., 2021). Acute extreme weather events have even more noticeable direct impacts because of their destructive potential, as they can cause injuries and death when they occur (Clayton & Crandon, 2025; Romanello et al., 2025). For instance, the 2025 monsoon floodings in Pakistan directly caused 881 deaths (WMO, 2025). Subacute weather events can have similar health impacts. Periods of prolonged extreme heat can cause acute kidney injury, heatstroke, pregnancy problems, development issues, sleep difficulties, and can worsen cardiovascular and respiratory conditions (Clayton & Crandon, 2025; Romanello et al., 2025). One study found that the 2025 summer heatwave in Europe was associated with 2305 excess deaths in 12 cities, with over 80% of these deaths occurring for people over the age of 65 (Clarke et al., 2025). Furthermore, increases in temperature can also indirectly impact health by facilitating the spread of various infectious diseases, like malaria and dengue (Romanello et al., 2025). Droughts and heatwaves can also contribute to the proliferation of waterborne and vectorborne diseases, as well as increase the likelihood of sand and dust storms because of the drier conditions, which can cause health problems for people with asthma or cardiovascular conditions (Romanello et al., 2025).

Indirect Effects. Indirect effects correspond to the impacts that climate change has on crucial determinants of health, including political, socioeconomic, and living and working factors (Charlson, Ali, Benmarhnia, et al., 2021; Lawrance et al., 2022). They may be experienced in the aftermath of extreme weather events, as the damage to structures, sanitation, and services (e.g., medical services, communication, transportation) can exacerbate the direct health impacts of these phenomena (Romanello et al., 2025). The Jude tropical cyclone, which hit Mozambique in March of 2025, led to 492,000 people being displaced, as well as over 3,000,000 hectares of cropland affected (WMO, 2025). Subacute weather events that affect agriculture and livestock farming can contribute to indirect impacts like malnutrition by augmenting pre-existing threats to rural industries and communities (see Hughes et al., 2016). This was evidenced by the drought that struck South-West Asia from 2024 to 2025, which reduced cereal production in Iran by 5%, having health and economic impacts in the region (WMO, 2025). Additionally, chronic changes in climate such as desertification, thawing permafrost, coastal erosion, and sea level rise may make certain areas uninhabitable for humans by decreasing access to food and fresh water sources and reducing the agricultural potential of these places (Clayton & Crandon, 2025).

Impacts on Mental Health

The evidence reviewed above indicates that climate change adversely affects multiple dimensions of health. Importantly, mental health, acknowledged by the World Health Organization (WHO, 2005) as a core dimension of health, is influenced by both physical and community health (Clayton et al., 2021; Lawrance et al., 2022). Thus, the same sources that have direct and indirect repercussions on these other dimensions of health, will also impact mental health.

Direct Effects on Mental Health. The level of destruction caused by acute extreme weather events can directly lead to various psychological problems, including trauma, anxiety and mood disorders, phobias, and substance abuse (Clayton et al., 2021), as well as reduce quality of life (Evans, 2019). As one meta-analysis has shown, people who experienced natural disasters also reported higher levels of psychological distress, and had almost twice the risk of developing psychopathological disorders, compared to their pre-disaster levels or non-exposed peers (Beaglehole et al., 2018).

The intensity of these psychological consequences can vary from event to event. Results from correlational studies assessing populations impacted by extreme weather events indicate increases in reported post-traumatic stress disorder rates following natural disasters ranging from 10% to 50% (Chen et al., 2020). This disparity results from differences in disaster-level factors (e.g., extent of losses and destruction), individual-level factors (e.g., sociodemographic characteristics, resources, previous experiences, coping ability), and family and community-level factors (e.g., resilience and support levels; Chen et al., 2020; Gauthier et al., 2025). While post-disaster psychological disorders tend to recover to pre-disaster levels after some time has passed, for some people they can be long-lasting (Chen et al., 2020; Clayton & Crandon, 2025; Thoma et al., 2021). Furthermore, as extreme weather events like floods, cyclones, and wildfires may reoccur in certain areas (for example, during monsoon periods, hurricane seasons, or in the peak of summer, respectively), their subsequent mental health impacts can have a quicker onset and higher intensity (Lawrance et al., 2022).

As for subacute weather events, global warming caused by climate change stands out as a powerful direct psychological stressor in the literature (see Charlson, Ali, Benmarhnia, et al., 2021; Lawrance et al., 2022). Heatwaves are associated with an increase in stress (Cianconi et al., 2020), possibly by disrupting sleep, and affecting neurotransmitters important for mood regulation, cognitive function, and mental performance in complex tasks (Liu et al., 2021). Additionally, when temperatures are hotter, people have been shown to engage in riskier behaviours, such as substance abuse, as well as experience heightened distress, increasing the risk of mental-health-related emergencies and suicide (Lawrance et al., 2022; Liu et al., 2021). Moreover, people with pre-existing mental health conditions are at an increased risk, given how increased heat can lead to neuroinflammation, which is associated with depression and psychosis (Liu et al., 2021). Some psychotropic medications also make people more sensitive to heat and decrease their body’s ability to regulate temperature (Lawrance et al., 2022; Trombley et al., 2017). One study highlighted rises in prevalence of mental health conditions in areas affected by chronic weather events, specifically increased temperatures and precipitation (Obradovich et al., 2018).

Indirect Effects on Mental Health. The indirect effects of climate change on mental health mirror its indirect impacts on wider health, as the social, community, and economic challenges to which climate changes contributes add additional strains on people and their relationships (Clayton et al., 2021). For example, increases in temperature and heatwave periods are consistently associated with increases in interpersonal violence, including assaults, sexual offenses and partner violence, and homicides (Clayton et al., 2021; Levy et al., 2017; Mahendran et al., 2021). Additionally, both acute and subacute weather events can threaten the livelihoods of people who depend on the natural environment for their food or as their source of income (Soutar & Wand, 2022). This can reflect in an increased risk of psychopathological disorders and suicide (Clayton et al., 2021; Middleton et al., 2020), as evidenced by a meta-analysis that linked droughts to depression and anxiety symptoms and suicide, through a variety of economic and social pathways (Vins et al., 2015).

Furthermore, acute and subacute weather events can require temporary or permanent displacement, depending on the extent of the damage (Cianconi et al., 2020). Environmentally-induced forced migrations lead to life-changing material, social, and cultural losses, as people abandon their homes, possessions, communities, and roles (Clayton et al., 2021; Shultz et al., 2019). It also increases people's exposure to violence, trauma, and other psychopathological conditions (Clayton et al., 2021; Shultz et al., 2019). When people have to leave their home environments or bear witness to how they have progressively deteriorated because of climate change, they can experience feelings of solastalgia, a form of psychological distress and pain caused by loss of valued and personally important places, and the inability to obtain comfort from a treasured place as one normally would (see Albrecht et al., 2007). This is particularly significant for Indigenous Peoples, who may not only have strong attachments to land, but whose culturally-meaningful practices and identities could fade with changes in their native environments (Clayton et al., 2021; Hill & Plume, 2024; Lykins et al., 2023; Middleton et al., 2020; Vecchio et al., 2022). For Pacific Peoples, for example, solastalgia may not capture the full extent of the personal, collective, socioeconomic, geographical, and historical impact of climate change on local communities (Galway et al., 2019; Tupou et al., 2023).

Overall, climate change impacts various dimensions of health through different connected and overlapping pathways, as its effects on the planet become increasingly common and far-reaching. Expanding upon previous similar frameworks (Berry et al., 2010; Bourque & Cunsolo Willox, 2014), Table 1.1 summarizes the direct and indirect effects of different types of weather events on health outlined in the previous paragraphs.

Table 1.1

Pathways of Climate Change Impacts on Physical and Community Health, and Mental Health

	Acute Weather Events (e.g., storms, flooding, wildfires)	Subacute Weather Events (e.g., heatwaves, droughts)
Physical and Community Health		
Direct Effects	Injuries; fatalities	Heatstroke; cardiovascular and respiratory issues; sleep difficulties; developmental issues; fatalities; proliferation of diseases
Indirect Effects	Destruction of homes and possessions; disruption of services and sanitation; loss of crop terrain	Malnutrition
Mental Health		
Direct Effects	Trauma; mood, anxiety, and stress disorders; phobias; substance abuse	Heat-related stress; exacerbation of pre-existing mental health conditions
Indirect Effects	Distress from loss of home and displacement	Distress from loss of source of income; social strain (e.g., heat-related violence); loss of valued places, culturally-valued practices; solastalgia

Vicarious Impacts. So far, I have presented examples of how climate change can impact the planet, physical and community health, as well as mental health, both directly and indirectly. Still, the impacts on climate change on health go beyond the physical effects it has on the environment, as people can also be impacted vicariously, through their awareness of the climate crisis and its ramifications (Lawrance et al., 2022; Pihkala, 2022b). This awareness may develop through first-hand experience with climate change (see Reser et al., 2014), or through mediated experiences like news and climate reports (Ojala et al., 2021), and social media (e.g., Buck et al., 2025; Smith et al., 2022). As people witness and learn about the impacts of climate change, they may experience diverse anticipatory reactions, such as worry, anxiety, stress, grief, hopelessness, powerlessness, and exhaustion (see Cianconi et al., 2020; Clayton et al., 2021; Ojala et al., 2021; Thoma et al., 2021), which can affect mental health (Clayton & Crandon, 2025; Fritze et al., 2008; Maran & Begotti, 2021; Palinkas & Wong, 2020).

These reactions can occur because of a combination of different distress-causing processes: people may be faced with deep questions about death, guilt, and meaninglessness, have to endure the uncertainty and unpredictability of climate change and its impacts, or they may go through disruptions to place identity and attachment because of environmental changes (Clayton, 2020; Pihkala, 2020a; Thoma et al., 2021). Vicarious impacts emerge when a person perceives their objects of care to be threatened, meaning the people, beings, places, and values that one finds important, has affection towards, and strives to protect and uphold (Wang et al., 2018). For some people, this includes perceptions that themselves and their loved ones could be threatened by changing climate conditions or extreme weather events, while for others, their objects of care may extend to people in more vulnerable conditions, future generations, animals whose habitats are disappearing, or even nature itself (Ojala et al., 2021). So, while solastalgia describes the emotional distress resulting from observed environmental degradation (Albrecht et al., 2007), vicarious impacts of climate change can also occur when a person expects or considers the possibility of future climate change impacting people and things they care about and feel connected to (see Kurth & Pihkala, 2022).

Vicarious emotional reactions to climate change are a global phenomenon. Different cross-national studies, each with their own scales and categorization methods, have found considerable proportions of their participants reported feeling very worried about climate change: 45.9% in one general population study (Ogunbode et al., 2022), and 60% in a study focused on children and young people (Hickman et al., 2021). Still, in both these studies there were substantial differences between countries. In a study examining worry about climate change across 11 European nations, Collery and Niedzwiedz (2025) found Portugal to have the highest proportion of very worried respondents (63.7%) and Italy the lowest (30.2%). The authors highlighted this could be because of different exposure levels, resources, governmental policies and priorities, and media framing of climate change. These emotional reactions are an increasingly common phenomenon. One cross-national survey study indicated 53% of people globally were more worried about climate change than they were in the previous year, and 1 in 3 people thought about climate change daily (Flynn et al., 2024). Looking at the United States (U.S.) specifically, results from cross-sectional surveys, repeated annually, suggest more Americans are becoming alarmed about climate change (Yale Program on Climate Change Communication, 2025).

Accordingly, research about the vicarious impacts of climate change has grown worldwide, particularly since 2020 (Jarrett et al., 2024; Momenpour & Choobchian, 2025), as has public interest on the topic (e.g., see Clayton, 2020; Gilder, 2023; Klugger, 2025). One term used to describe the wide variety of vicarious reactions to climate change is *climate anxiety* (Boivin et al., 2025). Researchers have described climate anxiety as a “practical anxiety” (Kurth & Pihkala, 2022) that is important in mobilizing people to fight climate change and adapt their lifestyle to be more environmentally-friendly (Pihkala, 2020a). Cases of people using their own climate anxiety as a catalyst for starting or joining climate change mitigation projects (e.g., Hamilton, 2025; Selig, 2025) or to advocate for systemic changes (e.g., Glover, 2025; Hibberd, 2025) have been reported in the media. However, climate anxiety can also be a difficult and sometimes overwhelming emotional experience to navigate (Clayton & Crandon, 2024; Ojala et al., 2021), meaning it can evolve into debilitating forms and people may struggle psychologically with it (Pihkala, 2022b; Sarkar et al., 2025). Climate activist Greta Thunberg is a famous example of such a case – when she first became aware of the magnitude of the climate crisis, she experienced deep feelings of depression and isolation, as well as sleeping and eating problems that caused her to loose almost 10 kg in 2 months (DeSantis, 2020). Similar stories abound in media (e.g., Matthew & Murray, 2020), and demonstrate the variety of concerns people have about climate change – some people even question the ethics of having children in a deteriorating world (e.g., Wells, 2025; see Dillarstone et al., 2023 for a review on this topic).

The variety of possible presentations and combination of potentially adaptive and maladaptive outcomes places climate anxiety in a singular position within the various impacts of the climate crisis, one where its value is often debated (Kurth & Pihkala, 2022). On the one hand, it can be a motivating factor in promoting planetary health and societal wellbeing through driving people's climate change mitigation efforts, but on the other hand, it can be a significant stressor straining people's individual wellbeing (Clayton, 2020). As such, it is critical to understand the extent of its negative and positive consequences, how common of a phenomenon climate anxiety is, and the factors determining which type of outcome takes place.

Thesis Goals and Structure

As climate change projections and impacts worsen, it becomes increasingly more difficult to ignore its impacts on different dimensions of health, particularly mental health. My thesis focuses specifically on climate anxiety as the diverse anticipatory reactions people have in response to climate change. This encompasses not only the reactions from people who have directly or indirectly been impacted by the climate crisis, but also those who are impacted vicariously (see Crandon, Scott, et al., 2024). Accordingly, one of my overarching goals for this thesis was to contribute to the ongoing efforts to refine the conceptualization of climate anxiety, by delineating this concept from neighbouring terms, outlining and integrating the variety of potential reactions to climate change that people report, and examining the adaptive and maladaptive potential of these reactions. My other goal was to add to the global effort to more closely monitor levels of climate anxiety in the general population, which could prove important to minimize the negative consequences of climate anxiety and maximize its potential benefits towards individual and planetary wellbeing. Both of these goals have been identified as key areas for research on the impacts of climate change on mental health in different research agendas (see Charlson, Ali, Augustinavicius, et al., 2021; Lawrance et al., 2024). In the paragraph below, I outline the chapters of this thesis and highlight the empirical studies which have been published or submitted for publishing.

In Chapter 2, I focus on the conceptualization and existing models of climate anxiety, with the goal of presenting an integrated overview that serves as the theoretical basis for the empirical chapters. In Chapter 3, I contribute to the consolidation of findings about the association between climate anxiety and wellbeing using a meta-analytic approach (study published as Gago et al., 2024). In Chapters 4 and 5, I shift my focus to methodological issues regarding the measurement of climate anxiety. In Chapter 4, I analyse how current climate anxiety measures capture this construct (manuscript submitted for publication, preprint available as Gago et al., 2025b), and in Chapter 5, I use Rasch methodology to select the best functioning items from these measures and a mixed-method approach to develop a holistic and condensed climate anxiety scale (manuscript under review, preprint available as Gago et al., 2025a). Using the insights from the previous studies, in Chapter 6, I present a study examining the prevalence, risk factors, and main outcomes of climate anxiety in a representative New Zealand sample (manuscript submitted for publication for Global Environmental Change, preprint available as Gago et al., 2026). Finally, in Chapter 7, I summarize, integrate, and discuss the findings from the previous chapters of the thesis, and reflect on their theoretical and practical implications, as well as where research on climate anxiety can go from here.

The studies in this thesis have all followed open-science practices to encourage replication and comparability of results. Each was pre-registered, and the data and materials have been made publicly available online on the Open Science Framework (www.osf.io). Links for each of these pre-registrations and available data are provided in the corresponding chapter, as well as in Appendix B.

Chapter 2

The study of climate anxiety is inherently interdisciplinary. To fully understand this complex phenomenon, it is important to have a grasp of concepts from various areas of psychology (e.g., clinical, cognitive, existential, social), environmental studies (e.g., climate change science, geographical vulnerability, broader ecological problems), sociopolitical (e.g., country-level environmental policies, resources, and vulnerability), environmental ethics and justice, among other scholarly fields (see Clayton et al., 2015; Pihkala, 2024b; Tsevreni et al., 2023). Likewise, given the global impacts of climate change, the study of climate anxiety is also inherently cross-cultural. It is important to recognize that Western knowledge systems are not the only way of explaining the psychological impacts of climate change, and there are diverse epistemologies and ontologies that more accurately describe the rich emotional experiences other groups can have in response to climate change (see, e.g., Aruta & Guinto, 2022; Newport et al., 2024; Schipper et al., 2021). As a result, there are multiple terms, conceptualizations, and explanatory models for climate anxiety used in the literature, contributing to a rich but fragmented field (see Boivin et al., 2025).

In this chapter, I will present and delineate some of the terms that have been used to refer to climate anxiety and neighbouring constructs, as well as other concepts that will be used throughout my thesis. This segment will act as a glossary for a variety of concepts that have sometimes been used interchangeably in the literature, to maintain consistency and clarity. Then, I discuss the most commonly reported features of climate anxiety in the literature, integrating them using recently published frameworks (Boivin et al., 2025; Watson et al., 2025) to describe the variety of vicarious responses to climate change. Following this, I introduce and integrate two explanatory models of climate anxiety (Crandon, Scott, et al., 2024; Pihkala, 2022b) that organize the aforementioned features, to provide a comprehensive functional outlook of this phenomenon and its potential outcomes. The conceptualizations and models I present in this chapter come from a Western perspective, as this has been the predominant approach in the literature (see Galway et al., 2019), and most participants in the empirical chapters are from Western countries, and as such, are likely to endorse Western worldviews. Other cultural perspectives of climate anxiety are briefly presented when relevant, and a more in-depth discussion of this limitation of the thesis is included in Chapter 7.

Differentiational Conceptualization

Using different terms for closely related phenomena, despite how similar they may be, allows for subtle differences in how they are understood because of the different connotations that accompany each word (Hodson, 2021; Pihkala, 2024b). In the climate anxiety literature, the terms and definitions used have historically been broad and their boundaries have been unclear, leading to a significant amount of overlap in how they are conceptualized (Cianconi et al., 2023; Coffey et al., 2021; Watson et al., 2025; for a historical perspective, see Christodoulou et al., 2024). Some terms that have frequently been used in this context so far include fear, worry, sadness, and distress (see Pihkala, 2024b for a review that includes other language-specific terms).

A consequence of the unclear boundaries between these various terms is that they have sometimes been used interchangeably (Coffey et al., 2021). In fact, climate anxiety has been described as an “umbrella term” (Boivin et al., 2025, p. 7), a catch-all concept that can apply to a variety of vicarious reactions to climate change. To provide a conceptual guide for the terms used in this thesis, in Table 2.1, I summarise some of the most common neighbouring terms of climate anxiety, and highlight how they differ from my conceptualization of this phenomenon, similar to the way previous scholars have in their conceptual reviews (e.g., Cianconi et al., 2023; Pihkala, 2024b; for a review on different definitions of climate anxiety specifically, see Dailianis, 2021; Hogg, 2025).

Table 2.1

Conceptual Definition and Differential Conceptualization of Neighbouring Concepts of Climate Anxiety

Concept	Conceptual Definition	Differential Conceptualization
Climate depression	Profound suffering, sorrow, hopelessness, helplessness, and fatalism associated with the climate crisis. Accompanied by feelings of loss of meaning in life and of pleasure in interests, social withdrawal, among others (Budziszewska & Kałwak, 2022, pp. 178-179; Cianconi et al., 2023, p. 216).	Similarly to anxiety, depression is also one of the potential strong emotional states people can experience in response to climate change (Pihkala, 2022c), but focuses less on the central aspects of uncertainty and worry that characterize climate anxiety (Boivin et al., 2025).
Climate despair (or eco-despair)	Involves feelings of emptiness, loss, and meaninglessness, as well as thoughts about deteriorating futures and doubts about having children, while still experiencing other positive emotions about other subjects (Cianconi et al., 2023, p. 216).	While feelings of despair are experienced in climate anxiety responses, climate despair itself is more closely related to helplessness and fatigue (Boivin et al., 2025; Leite et al., 2023).
Climate distress (or eco-distress)	Various kinds of distress that are significantly shaped by the climate crisis (Pihkala, 2024b, p. 25). Includes the diverse thoughts and emotions people experience after being exposed to triggers associated with climate change impacts, both present and anticipated (Lawrance et al., 2022, p. 463; Wardell, 2020, p. 188).	Significant overlap with more holistic conceptualizations of climate anxiety (e.g., (Crandon, Scott, et al., 2024), meaning it can be used interchangeably, although climate distress is considered more representative of the breadth of emotional reactions, and less pathologizing (Lawrance et al., 2022; Pihkala, 2024b; Watson et al., 2025).
Climate Doom	Belief that climate change will play a role in social collapse (Buck et al., 2025, p. 196).	While climate anxiety and climate doom may share some features (e.g., existential conflicts, catastrophization, see Crandon, Scott, et al., 2024), climate doom is exclusively focused on the most negative potential outcomes of climate

Concept	Conceptual Definition	Differential Conceptualization
		change (e.g., social breakdown, end of civilization), and is associated with more radical climate action (Buck et al., 2025).
Climate emotions (or eco-emotions)	Affective phenomena that accompany specific climate-change-related perceptions (Marczak, Wierzba, et al., 2023; Pihkala, 2022c).	Focused primarily on the emotions and related affective phenomena, does not include cognitive, behavioural, or physiological aspects of climate anxiety (Boivin et al., 2025).
Climate grief (or eco-grief)	Grief, sadness, yearning, and mourning associated with physical, environmental, identity, and cultural losses as a result of climate change (Cianconi et al., 2023, p. 216; Cunsolo & Ellis, 2018). Refers to present and past physical ecological loss or to future situations that trigger reminders of the loss (Comtesse et al., 2021, p. 7). More impactful for people with stronger ties to place (Lawrance et al., 2022). Can be an acute reaction and a more persistent mood state (Pihkala, 2024a).	Less future-oriented, more focused on losses that have already occurred (Cianconi et al., 2023, p. 216; Comtesse et al., 2021, p. 4; Kurth & Pihkala, 2022, p. 7).
Climate worry (or eco-worry)	Cognitive process characterized primarily by repetitive verbal thoughts (e.g., thinking “Climate change will cause more severe wildfires”, as opposed to picturing this in one’s mind) about climate change and associated negative affect (Stewart, 2021).	One of the components of anxiety (Cianconi et al., 2023; Sangervo et al., 2022), worry is usually considered less intense than anxiety (Pihkala, 2020a).
Eco-anger	Anger-related emotions (e.g., irritation, frustration, rage) associated with perceived harm, injustices, or obstacles preventing the achievement of goals (Pihkala, 2022c). For	More focused on transgressions that have already happened (Kurth & Pihkala, 2022, p.7). More closely related to pro-environmental engagement

Concept	Conceptual Definition	Differential Conceptualization
	climate change, this can include perceptions that powerful actors are not doing enough to mitigate climate change.	(Boivin et al., 2025; Stanley, Hogg, et al., 2021).
Eco-anxiety	Sociopsychological state characterized by fluctuating feelings of worry, distress, and apprehension in response to the observed and anticipated effects of climate change and other environmental disruptions, as well as their impacts on people's way of life and the perceived inadequacy of societal responses and policies (Boivin et al., 2025, pp. 9-10). Closely related to other eco-emotions, but a distinct phenomenon from them.	Encompasses emotional reactions linked to other ecological problems than climate change (Boivin et al., 2025; Pihkala, 2024b), such as overexploitation of resources, or pollution (see Voşki et al., 2023 for a framework of various ecological problems).
Eco-fear	Fear in relation to the ecological crisis that may be disruptive and paralysing (Cianconi et al., 2023, p. 215).	Triggered by specific concrete and immediate threats, whereas anxiety is associated with uncertainty (Boivin et al., 2025; Gawda, 2022; Pihkala, 2020a). Fear may trigger a fight response, whereas anxiety may trigger more preparatory behavioural responses to eliminate the threat (Gawda, 2022; Ojala et al., 2021; Parsafar & Davis, 2018).
Eco-paralysis	State of apathy that inhibits action that may be a consequence of a high level of climate anxiety (Cianconi et al., 2023, p. 215).	Climate anxiety can have the opposite effect of eco-paralysis, motivating pro-environmental behaviour (Kühner et al., 2025; Kurth & Pihkala, 2022).
Eco-phobia	Fear of overwhelming ecological problems or, alternatively, fear or hatred of the natural world (Cianconi et al., 2023, p. 215; Sobel, 1996, p.2).	Focused more specifically on fear and helplessness, less so on other emotional reactions (e.g., sadness, anger).

Concept	Conceptual Definition	Differential Conceptualization
Generalized Anxiety Disorder	Anxiety disorder characterized by excessive anxiety and worry about a variety of events and activities (e.g., job responsibilities, random misfortunes, household chores). This anxiety is difficult to control, causing distress or functional impairment (American Psychiatric Association, 2013, p. 222).	Climate anxiety is specifically associated with climate change and is not considered a psychological disorder (Pihkala, 2024b; Watson et al., 2025).
Meteoranxiety	Anxiety about the likelihood of extreme weather events or the absence of necessary weather events, such as rain during drought periods (Albrecht, 2019).	While it can be an aspect of climate anxiety, meteoranxiety is specific to occurrences of extreme weather, and not on chronic changes in weather patterns and resulting impacts (Albrecht, 2019).
Solastalgia	Distress caused by the deterioration of one's home environment, either because of climate change or other natural or artificial reasons. Inability to derive solace from these valued environments (Albrecht et al., 2007).	Related to deterioration that has already happened, not anticipated deterioration, and more focused on one's home environment (Cianconi et al., 2023, p. 216; Lawrance et al., 2022).

As evident in Table 2.1, although the terms used to describe people's reactions to climate change may vary in some respects, they also share some similarities. Almost all refer to anxiety or fear-related emotions (e.g., climate worry, meteoranxiety), with the exception of a few that allude to other emotions (e.g., climate depression, eco-anger). Some refer to ecological problems, while others are more specific to climate change. Some imply more intense reactions (e.g., climate doom) or have more explicit connections to psychopathology (e.g., eco-phobia), while others suggest less intense or more adaptive processes (e.g., solastalgia, climate grief). In the next few paragraphs, I will explore the differences between these constructs in greater depth. To better understand these differences, in Table 2.2, I also provide the conceptual definitions for other frequently used terms used in conceptualizing climate anxiety and neighbouring terms and throughout this thesis.

Table 2.2

Conceptual Definition of Concepts Used Throughout the Thesis

Concept	Conceptual Definition
Affect	Broad umbrella concept that includes core affect (see definition below), emotions, and mood (Ekkekakis & Russell, 2013).
Anxiety (domain-free)	Vague anticipatory emotion characterized by apprehension, hypervigilance, and somatic symptoms of tension (i.e., rapid heartbeat, muscle tension, shortness of breath). Focused on a future, more abstract threat. Can be a long-lasting response, and mobilize action on the threat, as well as prompt avoidance behaviours (American Psychiatric Association, 2013; American Psychological Association, n.d.; Barlow, 2002).
Concern	Feeling of apprehension experienced when an uncertain threat is considered likely to happen and severe enough, but does not necessarily involve a more personal feeling of worry or other emotional content, and is thus considered less intense (Gregersen et al., 2024; van der Linden, 2017). Less likely to be linked to behaviours aimed at reducing the threat (van der Linden, 2017).
Coping	Process of constantly changing cognitive and behavioural efforts to manage a specific situation, triggered by an appraisal of a stimulus as harmful (Folkman et al., 1986; Lazarus & Folkman, 1987). Coping first involves a process of cognitive appraisal of the threat and of the resources the person has to cope with it, followed by efforts aimed at remedying or changing the circumstances of the troubling person-environment situation, or regulating emotional distress (Lazarus & Folkman, 1987). Depending on the quality of the coping process outcome, a person may experience different emotional reactions, physiological changes, mood changes, and wellbeing consequences. Because every coping process is context-specific, no coping strategy is inherently adaptive or maladaptive (Folkman et al., 1986).
Core affect (or feeling, see Russell, 2003)	Neurophysiological state that is always consciously accessible and ever-present (Ekkekakis & Russell, 2013). Examples include pleasure, tiredness, and tension. It is a mental phenomenon, but it is non-cognitive and non-reflexive, it has no object. Core affect can be a component of the phenomenological subjective experience of mood and emotions, or it can be experienced in isolation with no emotional or mood correlates (e.g., feeling good without something to trigger that feeling, or accompanying emotional expression). It varies along an orthogonal continuum of valence (displeasure vs. pleasure) and activation (low vs. high),

Concept	Conceptual Definition
	and its function is to indicate preference or aversiveness. Not influenced by cultural factors.
Emotion	Episodic response to the appraisal of a stimulus or specific event, real or imagined (Ekkekakis & Russell, 2013). Examples include joy, disgust, fear, and sadness. Involves the coordinated action of multiple systems: core affect, cognitive appraisal and attribution, neurophysiological, facial expressions, and action. Emotions are subject to rapid changes because of continuous reappraisals or new triggering stimuli and have a strong impact on behaviour. They have high intensity, low duration, and can co-occur and covary. Emotions serve to orient attention and behaviour, and communicate internal states, and are thus influenced by cultural factors.
Mental health (or psychological wellbeing)	Integral component of health. More than the absence of mental health disorders, mental health is state of wellbeing in which a person experiences positive emotions, realizes their own abilities, can cope with normal stresses of life, can work productively, and contribute to their community (Vergunst, Williamson, et al., 2024; WHO, 2005).
Mood	Because it is vaguely linked to an object, mood sits between emotions and core affect when it comes to how cause-specific or diffuse it is (Ekkekakis & Russell, 2013). Thus, it also results from a cognitive appraisal process, although more scattered and broader than emotional appraisals. Examples include cheerfulness, irritation, and dysphoria. Mood states are long-lasting and low intensity (although it can be stronger, as in the case of mood disorders). A mood's function is to guide (or bias) information processing and cognition in a way that is congruent with the mood, and to prepare for future events. Also influenced by cultural aspects.
Pro-environmental behaviour	Actions taken with the aim of helping the environment (Watson et al., 2025, p.10). Examples include recycling, eating less meat, avoiding plane travel, participating in a climate protest, or voting for pro-environmental policy. Pro-environmental behaviours vary in their effectiveness (e.g., the amount of carbon that is not released into the atmosphere), who performs them (individual vs. collective), if they are aimed at mitigation or adaptation to climate change, among other dimensions (Brick et al., 2024; van Valkengoed & Steg, 2024).
Psychological disorder	Health condition characterized by some combination of abnormal changes in thoughts, emotions, perceptions, behaviours, or relationships with others (symptoms). Associated with distress and functional impairment. Can range from mild to severely impairing, and from time-limited to chronic (American Psychiatric Association, 2013; Lawrance et al., 2022).
Stress	State characterized by negative person-environment relationships, appraisals, and emotional responses (Lazarus & Folkman, 1987,

Concept	Conceptual Definition
	p. 142). Physiological or psychological response to an internal or external stimulus that is usually displeasing, and involves changes in a variety of systems of the body (American Psychological Association, 2018). Stress is a normal part of everyday life, but at higher levels it can impair functioning and be associated with psychopathological disorders (see American Psychiatric Association, 2013).
Symptom	Enduring or recurring subjective experience, or behaviour pattern, that is considered to be indicative of a mental health problem (Wilshire et al., 2021, p. 324).
Worry (domain-free)	Repetitive thinking about an uncertain future event that is accompanied by anxiety-like negative affect (Ojala et al., 2021). Worry is typically focused on threats to a person's everyday duties and responsibilities (Gawda, 2022). Often associated with adaptive behaviours to reduce a threat (Barlow, 2002; van der Linden, 2017), it is considered part of the coping process (Ojala et al., 2021; van der Linden, 2017). Requires a person to believe a threat is likely, potentially severe, and to develop a more broad concern about it (van der Linden, 2017).

To differentiate between the various concepts used in the climate anxiety literature, first, it is worth discussing the difference between eco-anxiety and climate anxiety. Terms using the prefix "eco-" are understood as referring to the wider environmental crisis, not just climate change (see Pihkala, 2024b, p. 25). Ecological problems other than climate change include stratospheric ozone depletion, the quality, availability, and use of freshwater, biodiversity loss, and chemical pollution (Voşki et al., 2023). Thus, a person who feels anxious about the current state of landfills or the pollution of local waterways can be said to be experiencing some degree of eco-anxiety, but not necessarily climate anxiety. Climate anxiety is therefore considered a subset of eco-anxiety, specifically focused on the climate crisis (Cianconi et al., 2023). However, because of the way different environmental problems can interact and exacerbate one another (see Chapter 1), the conceptual differences between climate and more general eco-anxiety can be thin (Pihkala, 2020a). One empirical example of this comes from participants in a qualitative study, who expressed holistic concerns as well as negative affect and emotions about various environmental problems without always clearly differentiating between specific issues (Voşki et al., 2023).

After specifying the object of interest as climate change (rather than wider ecological problems), my focus shifts to the term used to describe the affective reaction itself. Here, as seen in Table 2.2, options include anxiety, distress, worry, among others, but I will focus primarily on the term “anxiety” as this is the one I opted to use in this thesis. Anxiety emerges when a person is faced with a potentially harmful uncertain threat that they consider relevant to them (Ekkekakis & Russell, 2013; Folkman et al., 1986; Pihkala, 2024b); it is an anticipatory emotion (Böhm, 2003) related to fear (Gawda, 2022), and its function is to orient the person to attend to, and find a way to deal with, the uncertainty and unpleasant emotional experience it generates (Barlow, 2002; Kurth & Pihkala, 2022; Sangervo et al., 2022). Anxiety is a fundamental emotion or mood state that is experienced both in everyday life and in clinical situations (Gawda, 2022). Concordantly, in the context of climate anxiety, the term “anxiety” alludes not only to stronger states of potentially debilitating anxiety, but also to milder emotional anxiety reactions to climate change (see Pihkala, 2022b; Wardell, 2020).

However, there are concerns associated with the use of the term anxiety in the context of psychological reactions to climate change. A common criticism is that it pathologizes what should be considered an appropriate reaction to facing the climate crisis (Bhullar et al., 2022; Pihkala, 2024b). By classifying it as an “anxiety”, likening it to a social anxiety or generalized anxiety disorder, the emotional reaction the person is experiencing is implicitly categorized as excessive or otherwise unjustified (see the diagnostic criteria in American Psychiatric Association, 2013). Furthermore, it can be framed as a way to blame and isolate individuals for not adequately regulating their climate emotions, instead of focusing on the systemic factors that have contributed to the development of the climate crisis (Bhullar et al., 2022; Pihkala, 2024b; Wardell, 2020;

Wray, 2024). This can have implications for mitigating climate change – one experimental study in Norway found that people were more likely to support taking into account people's climate worry or climate concern in policymaking decisions, compared to people's climate anxiety. The authors hypothesized that climate anxiety was seen as an individual's exaggerated or irrational threat reaction (Gregersen et al., 2024).

Additionally, while anxiety is considered an important part of the emotional reaction to climate change, some scholars argue that using the term "anxiety" is too reductive, as anxiety is only one of the various emotions people can feel in relation to the climate crisis (Pihkala, 2024b; Wray, 2024). For example, while climate anxiety is a good fit to describe the worry, nervousness, and fear responses that people report, it overlooks grief and self-reflective (i.e., guilt, shame) emotions (Kurth & Pihkala, 2022). Moreover, these different emotions have distinct outcomes (e.g., Contreras et al., 2024; Pihkala, 2024b; Stanley, Hogg, et al., 2021), so amalgamating them under an umbrella term risks diluting their specific effects on mental health or pro-environmental behaviour (Kurth & Pihkala, 2022). Lastly, as mentioned previously, the term climate anxiety does not fully convey the emotional experience of people who live in the Global South, or of Indigenous Peoples (Tupou et al., 2023; Wray, 2024).

Nevertheless, and despite the important concerns in using "anxiety" in relation to climate-related psychological responses, climate anxiety is already a commonly used term both in academia and among the general public (Hickman, 2024a; Pihkala, 2024b), making it a practical and easily recognizable term that facilitates communication, makes people feel like their climate emotions are validated, and allows for resources to be allocated to help people suffering from it (Clayton, 2020; Hickman, 2020). Therefore, there are benefits associated with the use of climate anxiety as an umbrella term, justifying its use in interdisciplinary research.

Among the various alternatives to climate anxiety, I will briefly focus on the term "climate distress", as it is perhaps the most consensual. Similarly to climate anxiety, the term climate distress is simultaneously used to characterize a temporary period of mental disturbance and physiological reactions, as well as longer-lasting clinical problems, symptoms, and associated functional impairment (Pihkala, 2024b). Both of these terms describe difficult mental states and are frequently defined as including aspects typical of stress, anxiety, and depression disorders (Pihkala, 2024b). Still, some scholars argue the term distress is a better representation of the variety of emotional responses, and is also less pathologizing than anxiety, thus better reflecting the adaptive potential of this phenomenon (Cianconi et al., 2023; Lawrance et al., 2022; Pihkala, 2024b; cf. Clayton & Karazsia, 2020). While I have opted to use the term "climate anxiety" for my thesis, I recognize that my conceptualization of the term has a large overlap with "climate distress" as defined by other scholars and agree with their reasoning for selecting this term. Still, I use "climate anxiety" for consistency within the empirical studies in this thesis, and with the majority of the literature on this topic (e.g., Clayton & Karazsia, 2020; Hogg, Stanley, & O'Brien, 2024; Pihkala, 2020a). I return to this discussion in Chapter 7, where I reflect on the conceptualization of climate anxiety based on the findings from the empirical chapters, and my recommendations for future studies on the topic.

Conceptualization

Having delimited climate anxiety from its neighbouring terms, I will now detail what the climate anxiety response entails. Recently published frameworks (Boivin et al., 2025; Watson et al., 2025) have proposed preliminary categorizations of the various dimensions involved in reacting to climate change, contributing to a more integrated understanding of the various concepts discussed in the climate anxiety literature. According to these frameworks, climate anxiety is considered an affective response to the awareness of climate change, but itself includes affective (climate emotions and affective wellbeing), cognitive (beliefs and concerns about climate change, perceptions of threat and control, personal values), behavioural (coping responses and behavioural changes), and existential (meaning, spirituality) dimensions. Furthermore, it has implications for mental health and wellbeing, as well as planetary and ecological wellbeing. It is also moderated by vulnerability and protective factors at different systemic levels (see also Lawrance et al., 2022). While these frameworks are continuously evolving, they serve as a guide to describe the various distinctive features of climate anxiety in the next sections. The aim of these sections is to highlight some of the more distinctive features of climate anxiety, building upon the work of two recent frameworks as well as previous systematic reviews on the topic (e.g., Coffey et al., 2021; Dailianis, 2021; Pihkala, 2024b).

Response to a Stressor

First, one of climate anxiety's dimensions is that it is a psychological response, meaning it requires a stressor to trigger it (Boivin et al., 2025; Watson et al., 2025). As mentioned in Chapter 1, there are a variety of pathways through which climate change can lead to this response, some direct, others indirect, and others vicarious (Middleton et al., 2020; Thoma et al., 2021). Climate anxiety is often experienced vicariously, meaning it does not require direct experience with climate change to be triggered and may emerge from simply being aware and knowledgeable of the climate crisis and its impacts (Dailianis, 2021; Hickman, 2020; Lawrance et al., 2022; Watson et al., 2025), although it may be exacerbated by experiencing these impacts directly (see Lawrance et al., 2022). For example, bearing witness to destruction and death caused by extreme weather events can be associated with increased distress about climate change (Boivin et al., 2025; Lawrance et al., 2022; Reser et al., 2012). While this may be a powerful factor linked to climate anxiety (see Kühner et al., 2025), it is not the only pathway to trigger this response.

Climate anxiety may also be experienced through mediated exposure. In today's world, traditional and social media play a big part in this process. Climate change's global impacts are increasingly reported upon and portrayed as a substantial threat to life, with a lesser focus given to potential solutions, increasing the salience and danger of the climate crisis in the minds of the public (Boivin et al., 2025; Höijer, 2010) and associated negative emotions (e.g., Buck et al., 2025; Maran & Begotti, 2021; Shao & Yu, 2023; C. Smith et al., 2022). Boivin et al. (2025) identify other stressors that may trigger climate anxiety responses, namely how climate change information is communicated by authority figures on the topic (including educators and parents), the lack of significant systemic action to mitigate climate change, and perceived individual and collective inefficacy in these efforts.

Affective Dimension

While climate anxiety responses involve a variety of dimensions, they are still considered fundamentally affective responses (Crandon, Scott, et al., 2024; Pihkala, 2024b; Watson et al., 2025), encompassing emotions beyond anxiety (Cianconi et al., 2023; Coffey et al., 2021; Léger-Goodes et al., 2022). The importance of climate anxiety's affective dimension is further established by research on domain-free affective phenomena, which have been shown to have important implications for cognition, behaviour, and wellbeing (Ekkekakis & Russell, 2013; Pihkala, 2022c). As will be described below, this is also the case in the climate change domain. Research on climate-related affective phenomena have highlighted the various core affect, emotions, and mood states that have been reported in the context of climate change, although these have not always been clearly conceptually differentiated (Pihkala, 2022c). As such, it is worth discussing the various affective responses of climate anxiety in further detail and positioning them in relation to existing affective and emotion theories.

One influential theory in this context is Russel's (1980) circumplex model of core affect, which describes core affect as varying across two orthogonal axes: valence (on the horizontal axis), ranging from displeasure (e.g., upset) to pleasurable states (e.g., happiness), and activation (on the vertical axis), ranging from high-activation states (e.g., excitement) to low-activation states (e.g., calmness). Climate anxiety experiences lie primarily on the negative valence side, as it is for the most part an aversive experience. As for the activation axis, climate anxiety involves affective states belonging to both high (e.g., alarmed) and low-activation states (e.g., tiredness) as well as states in between these two ends of the activation spectrum (see Voşki et al., 2023). These include states of tenseness, distress, frustration, sadness, and depression that have been described in the climate anxiety literature (Coffey et al., 2021; Crandon, Scott, et al., 2024). These distinct affective states can share similar levels of valence and activation and emerge from closely related neural mechanisms, which make the differentiation between them particularly challenging (Pihkala, 2022c; Posner et al., 2005).

Similarly to core affect states, various emotions and mood states characterize climate anxiety. Pihkala's (2022c) taxonomy provides the most comprehensive framework of climate emotions to date. These emotions vary in intensity and duration – some are short-lived (e.g., surprise) while others are experienced for a longer period (e.g., grief), and some emotions may be experienced in milder and more intense forms (e.g., anxiety and depression). Some of these emotions are more related to the consequences of climate change, varying in whether they are retrospective (e.g., sadness) or prospective (e.g., anxiety), while others are more related to perceived ethical violations and evaluations of actions as praiseworthy or morally wrong, varying between self-related (e.g., guilt) and other-related emotions (e.g., anger; see Böhm, 2003).

Threat-related emotions, such as fear, anxiety, and dread, characterize an important part of the affective dimension of climate anxiety (Böhm, 2003; Pihkala, 2022c). Like worry, which is discussed both as a cognitive and affective aspect of climate anxiety (cf. Pihkala, 2022c; Watson et al., 2025), these prospective emotions are connected to perceptions of climate change as a significant, uncertain threat to the individual or an object they care about. Accordingly, the intensity of these emotions can vary greatly, depending on the appraisal process (see Lazarus & Folkman, 1987). Thus, threat-related emotions can be mild and preparatory (i.e., worry, fear), or intense and paralyzing (i.e., panic, dread, horror; Pihkala, 2022c). Feelings of helplessness and powerlessness can also accompany these more intense threat-related emotions. Like threat-related emotions, loss-related emotions are also a central response to climate change, and are considered to be closely interconnected (Pihkala, 2022c, 2022b). These emotions also vary in intensity and duration, ranging from brief sadness, to longer grieving processes, to stronger bereavement states. Emotions related to retrospective loss can be more specific to particular losses (such as solastalgia, which is more place-based), or experienced in a broader form, related to global deterioration (Pihkala, 2022b).

While most threat-related emotions experienced in regards to climate change are mild in intensity (see Ojala et al., 2021), Pihkala (2022c) highlights that stronger states of anxiety and depression are also a possibility, and should therefore be differentiated from milder and practical forms of these emotions. These stronger states include a variety of more intense and longer-lasting emotions, such as hopelessness, overwhelm, meaninglessness, worthlessness, and despair. Yet, these stronger anxiety and depression states can also lead people to experience affective numbness, resignation, and apathy, as a form of coping with their overwhelming climate emotions.

Another group of emotions that are relevant for the climate anxiety response are anger and betrayal-related emotions. These other-related emotions emerge from perceptions of injustice and lack of care, and lead to moral outrage, disappointment, and resentment, which in turn can be associated with feelings of distress (Henritze et al., 2023). Feelings of betrayal and frustration can be directed at government and decision-makers over their lack of climate action and inability to significantly mitigate climate change, or at groups that contribute to ongoing climate change for their own gain (also described as a form of moral injury; see e.g., Henritze et al., 2023; Hickman et al., 2021). These anger-related feelings may also be directed at peers who disregard climate concerns (Pihkala, 2022c). Accordingly, climate anger has been reported to be more closely associated with pro-environmental behaviour than other climate emotions (Contreras et al., 2024; Stanley, Hogg, et al., 2021).

While less prominent in the overall climate anxiety experience, other emotions may also be present. Learning about the extent of the climate crisis can be associated with surprise, disappointment, and confusion over what can be done to mitigate it, as well as stronger instances of shock and trauma (Pihkala, 2022c). These surprise and shock-related emotions have also been linked to feelings (and corresponding behaviours, in more intense instances) of isolation and loneliness, reflecting beliefs that people do not share their views and feelings about climate change. Part of this initial shock involves a realization of participating in a system that has contributed to the climate crisis, leading to self-related feelings of inadequacy, guilt, and shame (see also Böhm, 2003). Finally, it is important to note that climate anxiety can also include positively valenced emotions. Pihkala (2022c) identifies motivation and determination to act against climate change, which could result from the feelings of guilt and would accompany and fuel the pro-environmental behaviours that climate anxiety has been associated with (see Kurth & Pihkala, 2022). Feelings of pleasure, pride, joy, optimism, and empowerment may emerge from engaging in these pro-environmental activities, as well as feelings of love, care, and connection towards others engaged in similar behaviours and towards the natural world in general.

These various emotions can be difficult for an individual to discern from one another (see Soutar & Wand, 2022). Moreover, they can oscillate quickly between one another depending on contextual factors; it is common for people to simultaneously experience contrasting emotions like anxiety and hope (Hickman, 2020; Marczak, Winkowska, et al., 2023; Pihkala, 2022b; Verlie, 2019). Consequently, the overall affective experience of climate anxiety can be diffuse and challenging to describe in full.

Cognitive-Behavioural Dimension

As seen in the previous section, climate anxiety is characterized by appraisals that climate change is a threat that has caused significant losses and may cause more in the future, and this threat may be related to morally-reprehensible actions from oneself and others (Marks & Hudson, 2024). According to cognitive-behavioural theory, these cognitive appraisals have an important role in influencing emotional and behavioural reactions (Crandon, Scott, et al., 2024; Marks & Hudson, 2024). Schema theory proposes that underlying cognitive structures, known as schemas, are activated by a relevant stressor (D. A. Clark & Beck, 2010; Ehring, 2014). These schemas consist of core beliefs about oneself, the world, and the future (e.g., “The world is a dangerous place”, or “I am a capable person”), as well as assumptions or rules that one must follow (e.g., “If I cannot handle my emotions, others will think I am crazy”, or “If everyone does their part, the world can become a peaceful place”). Schemas bias information processing and appraisals by evoking automatic thoughts (e.g., “I am in danger”) and prioritizing information that is congruent with the content of the schema. As a result, they influence the thoughts, emotions, and behaviours that result from the appraisal process. For people who do not have a psychological disorder, schemas tend to be balanced in valence, including both positive and negative beliefs, as well as flexible, meaning that a person’s assumptions are not overly strict, exaggerated, or demanding. On the other hand, people with mood or anxiety disorders, for example, are more likely to have schemas that are biased towards negative information and assumptions that are more difficult to consistently fulfil.

In the context of climate change, schemas tend to focus on bleak futures (e.g., “Climate change will threaten my livelihood”), the suffering of others (e.g., “Our children will have to face the consequences of climate change”), and a moral responsibility to do something to fight climate change (Marks & Hudson, 2024; Soutar & Wand, 2022). While these schemas are valid and accurate, they may be accompanied by more rigid rules or pessimistic beliefs. Examples would include seeing climate change as the end of the world, assuming that others do not care about these issues, and that one's thoughts and emotions are inadequate and will lead to social rejection (Marks & Hudson, 2024). These negatively skewed, unconstructive appraisals, are characterized by self-critical and catastrophizing thoughts, and as such, more likely to be accompanied by negative emotions and physiological reactions. Similarly, they may prompt further unhelpful cognitive-behavioural coping responses like repetitive thinking about climate change that is difficult to control (rumination), hypervigilance to negative information, emotional suppression, and social withdrawal, which may feed these same negative beliefs and accompanying distress.

Conversely, a person may have more constructive beliefs about climate change. They may still believe that the future is bleak, but also consider the possibility of a brighter future (Marks & Hudson, 2024; Soutar & Wand, 2022). Whereas maladaptive schemas involve rigid rules about how one should feel and act, constructive schemas comprise thoughts characterized by greater acceptance of one's own emotional reactions and more realistic goals for pro-environmental action. Constructive beliefs are grounded in hope and are more likely to contribute towards positive emotions and increase motivation to act pro-environmentally in a way that better balances the needs of the person and the planet (Marks & Hudson, 2024).

Existential Dimension

Climate anxiety is often described as having an existential dimension (Clayton, 2020; Ojala, 2016; Pihkala, 2020a). The magnitude and global reach of the climate crises can increase the salience of deep-seeded feelings about something being fundamentally wrong in the world, making a person engage with core questions about existence. These conflicts are inherent to the human condition, and while it may be a painful process, working through them is an essential part of life and therefore not indicative of underlying psychological problems (Budziszewska & Jonsson, 2021; Rehling, 2022; Vaškovic & Vičanová, 2024). However, psychological problems can arise from avoiding engaging with existential questions, or becoming so absorbed by them that they become overwhelming (Budziszewska & Jonsson, 2021). Using existential theory frameworks, scholars have identified the most prominent existential conflicts associated with climate change, including death, isolation, meaning, and freedom and responsibility (Langford, 2002; Rehling, 2022).

Fear of death and nothingness is a universal existential conflict, as life cannot exist without death (Langford, 2002; Rehling, 2022). According to Terror Management Theory, awareness of one's mortality can trigger personal and social defences to reduce the anxiety it causes, by reinforcing self-esteem, worldviews, and in-group belonging (Jonas et al., 2014). Research shows that climate change anxiety is associated with death anxiety (Abou Jaoude et al., 2024; Fekih-Romdhane et al., 2024). Being aware of climate change's potentially catastrophic future effects means having to face the inevitable reality of death or non-existence, and this extends not just to the death of the self, but also to the death of future generations, human civilization, and the natural world (Budziszewska & Jonsson, 2021; Passmore et al., 2023; Rehling, 2022; Soutar & Wand, 2022). This awareness of death is connected to feelings of anxiety, grief, bereavement, and solastalgia, but may also lead to personal growth (Langford, 2002; Rehling, 2022). For climate change, salient ideas of mortality can thus lead people to actively avoid climate-related information or actively deny or minimize it (see Norgaard & College, 2006), engaging in actions that increase their preparedness, or become antagonistic towards people with opposing environmental perspectives (Wolfe & Tubi, 2019).

Another relevant existential conflict is isolation, related to the idea that it is impossible to truly and completely understand another's internal world (Rehling, 2022). As mentioned in the previous sections, in the context of climate change, experiencing strong climate emotions can feel alienating (see Pihkala, 2022b), and people may believe that others do not share their concerns to the same degree (see Budziszewska & Jonsson, 2021; Marks & Hudson, 2024; Passmore et al., 2023; Rehling, 2022). Social interactions can become more challenging and confrontational, and require people to more closely regulate their emotions, thoughts, and behaviours so as not to push others away (Passmore et al., 2023; Rehling, 2022). Additionally, losses resulting from climate change can also disconnect people from important places and from past or ancestral history, contributing to feelings of narrative discontinuity and incongruence (Passmore et al., 2023). On the other hand, the global reach of climate change can touch on people's sense of relatedness and connectedness to all other living beings (Budziszewska & Jonsson, 2021). People become aware that they share a common fate with others and nature, which can be met with feelings of fragility and conflict, or with compassion, solidarity, and care for others. Environmental activists highlight these feelings of connection and cooperation as a significant reason for persisting in their pro-environmental action, showing how engaging with and expressing existential conflicts can have adaptive wellbeing outcomes for individuals and the planet (Budziszewska & Jonsson, 2021; Marczak, 2024).

Another universal existential challenge is the need to find and pursue one's own meaning in life, or derive meaning from things in it (Passmore et al., 2023; Rehling, 2022). Ultimately, stronger forms of climate anxiety can make people feel like there is no point in continuing to fight it, and that life itself may therefore be meaningless (Budziszewska & Jonsson, 2022; Cianconi et al., 2023; Pihkala, 2022c; Rehling, 2022). The lack of significant progress in mitigating climate change and the ineffectiveness of individual action can weaken this sense of purpose, making people question what is the point in trying, or enjoying anything at all (see Budziszewska & Jonsson, 2021; Rehling, 2022). This conflict is closely related to the fear of death, as they share concerns about lack of a future, emptiness, and non-existence (Budziszewska & Jonsson, 2021; Rehling, 2022).

The overwhelmingness of climate change can also challenge people's ability to act in a way that is congruent with their values. People may want to act in ways that protect the environment, but feel unable to do so because they are unsure of what to do (see Dailianis, 2021; Rehling, 2022). Similarly, they may question other major decisions in their lives, such as whether they should have children in a climate change world (e.g., Budziszewska & Jonsson, 2021; Rehling, 2022). Because there is no single entity responsible for fighting climate change, people have the freedom to make personal choices about how to act (or not to act) to mitigate the climate crisis, and are therefore deemed responsible for those choices (Langford, 2002; Passmore et al., 2023; Rehling, 2022). Thus, hesitancy and paralysis are connected to self-criticism and feelings of powerlessness, resignation, and guilt; action, conversely, is linked to a sense of increased purpose, meaning, and hope (Langford, 2002; Rehling, 2022; Soutar & Wand, 2022). Notably, people can oscillate between these different states (Budziszewska & Jonsson, 2021).

Socio-Ecological Considerations

The previous section described the various dimensions through which climate anxiety can manifest for individuals. The way that each of these dimensions is experienced and expressed is moderated by multiple factors, and therefore it can impact people differently according to their specific conditions (Boivin et al., 2025; Cianconi et al., 2023; Clayton, 2020; Léger-Goodes et al., 2022). These factors are not just characteristics of the individual, but also of their social circle, their wider society, and their geographical location (Clayton & Crandon, 2025). Systemic social-ecological theory offers a useful framework to organize the multitude of moderating factors and account for how they interact with one another (Berry et al., 2018; Crandon, Thomas, et al., 2024). Therefore, I will present some of the factors identified in the literature as influencing climate anxiety responses at the individual, micro, meso, exo, and macrosystem levels (Crandon, Thomas, et al., 2024).

The individual level includes biological, developmental, and psychological characteristics of the person (Crandon, Thomas, et al., 2024). In the case of climate anxiety, people may be more vulnerable to climate anxiety if they have already experienced other climate impacts themselves (e.g., Kotera et al., 2025; Kühner et al., 2025). Similarly, having had or currently having physical or mental health conditions can make coping with climate anxiety more demanding (e.g., Boyd et al., 2024; Woodland et al., 2023). Demographically, certain groups have been considered to be particularly vulnerable because of increased awareness, lower agency, or being more concerned about the future (Boivin et al., 2025). Studies indicate younger people, women, parents, and people working in jobs closely dependent on the environment (such as scientists or farmers) are at particular risk (see Boivin et al., 2025; Clayton, 2020). Psychological risk factors include a neurotic personality (Kühner et al., 2025; cf. Ogunbode et al., 2024), elevated trait anxiety (e.g., Nadarajah et al., 2025; Parmentier et al., 2024), or high intolerance to uncertainty (e.g., Mouguiama-Daouda et al., 2026). On the other hand, having a varied repertoire of coping behaviours can help in protecting against the more maladaptive outcomes of climate anxiety (Crandon, Thomas, et al., 2024; Pihkala, 2022b).

The microsystem level includes the people and environments closest to the individual, with which they interact directly (Crandon, Thomas, et al., 2024). This encompasses one’s family, friends, coworkers, as well as their homes or any place that they spend most of their time in. The amount of social support available and how a person’s family and peers perceive and react to their own climate-related experiences will shape how the person experiences and processes these events (see e.g., Chan, Tam, et al., 2025; Ojala & Bengtsson, 2019). Additionally, being in natural spaces like parks, forests, and lakes, can be a comfortable experience away from the tensions of urban living, and may therefore buffer climate anxiety (see H. Li et al., 2024); thus it is also important whether or not these are readily accessible and whether the person spends time in them (Crandon, Thomas, et al., 2024). In this modern age, the microsystem also involves the technological devices and social media used to interact with people's social circles and the wider world (known as the techno-subsystem, see Crandon, Thomas, et al., 2024). The amount, accessibility, and quality of information about climate change impacts and solutions can exacerbate or alleviate climate anxiety, respectively (e.g., Dominguez-Rodriguez et al., 2025; Morris et al., 2025).

The mesosystem includes the person's community and local environments (e.g., schools, workplaces, neighbourhoods, parks). If these are adequately prepared for climate change impacts, and encourage collective action and support, adaptive outcomes for individuals are more likely, whereas if they avoid or suppress climate-related discourse or experience impairing climate impacts, individual's climate anxiety may increase (Crandon, Thomas, et al., 2024; Hayes et al., 2019; Norris et al., 2008).

The exosystem level includes structures that the person has no interaction with, but nonetheless influence their life, including governmental and educational systems, healthcare, and media (Crandon, Thomas, et al., 2024). As mentioned in previous sections, government inaction and disavowal of the climate crisis and inadequate policies and planning can contribute to climate anxiety (see Berry et al., 2018; Hickman et al., 2021), whereas trust in the government's responses to climate change could have the opposite effect (see Cebeci et al., 2025).

The macrosystem extends beyond the exosystem by encompassing wider cultural and societal factors, including laws, belief and value systems, history, and traditions, as well as the geographical location of where they live (Crandon, Thomas, et al., 2024). Here, belief systems that value the natural environment can be important protective factors (see Gifford & Nilsson, 2014), as is the support and meaning derived from spiritual and religious beliefs, organizations, and places (Pihkala, 2022a; Tiatia et al., 2023). Conversely, cultural or economic systems that disregard the environment over personal gain can exacerbate climate anxiety (see Weintrobe, 2020).

Potential Outcomes and Clinical Considerations

As discussed throughout this section, all dimensions where climate anxiety can manifest have the potential to lead to adaptive and mal-adaptive responses. As such, several scholars have argued for conceptualizing the outcomes of climate anxiety as a spectrum (e.g., Christodoulou et al., 2024; Doherty & Clayton, 2011; Lutz et al., 2023; Pihkala, 2019; Vergunst, Williamson, et al., 2024). On one end of the spectrum there are milder or more adaptive forms of climate anxiety, whereas on the opposite end exist severely impairing forms of climate anxiety.

On the adaptive end, climate anxiety can be a mild and constructive reaction that motivates pro-environmental behaviour for people (Clayton, 2020; Kurth & Pihkala, 2022). These milder forms are characterized by the ability to engage with climate stressors in a balanced way that, despite experiencing slight momentary distress, still acknowledges the possibility of positive outcomes and the ability to disengage or be reassured when needed (Hickman, 2024b). Consequently, social connections are maintained, although some functional impairment may be present, including occasional insomnia or difficulty in decision-making (Pihkala, 2019). Trust and responsibility to solve the climate crisis is mainly placed on authority figures and on technological advances, and emotional self-care may be prioritized over climate concerns in distressing situations (Hickman, 2024b). Nonetheless, these milder or moderate forms of climate anxiety may still drive pro-environmental behaviour change (Boivin et al., 2025). Quantitative studies show that climate anxiety (or neighbouring constructs) is associated with increased engagement in pro-environmental behaviours (see Kühner et al., 2025 for a meta-analysis). This finding is substantiated by qualitative studies, showing people often attribute their climate anxiety feelings as one of the reasons that they started changing their behaviour to be more pro-environmental, or as what keeps them engaged in environmental activism (e.g., Bright & Eames, 2022; Ojala, 2007).

However, for others, climate anxiety may be so intense that it becomes invasive and chronic (Boivin et al., 2025; Clayton & Crandon, 2024; Hickman, 2020; Pihkala, 2020a). These more significant and severe forms of climate anxiety are characterized by daily intense distress, intrusive negative thoughts, catastrophizing, and difficulties in self-regulating and defending against these emotions and beliefs (Hickman, 2024b). Less trust is placed on others, and there may be a greater personal burden to behave pro-environmentally, as well as accompanying self-criticism over not doing enough, guilt, and burnout. Paradoxically though, climate anxiety may have the opposite effect to motivation – perceiving climate change as an overwhelming threat that is beyond a person's or society's coping abilities, thereby inhibiting engagement in mitigation efforts (Dailianis, 2021; Innocenti, Santarelli, et al., 2023). This inability to engage in behaviours one considers important is itself an example of how mental health may be impacted by climate anxiety (WHO, 2005).

Along with this eco-paralysis, intense climate anxiety may impair functioning and quality of life in various other ways, by interfering with a person's ability to sleep, work, and socialize (Clayton, 2020; Hickman, 2024b). Social relationships, particularly close ones, may be strained because of differences in perspectives about the climate crisis and what to do about it (Hickman, 2024b). Moreover, scholars have reported instances of irritability, weakness, physiological symptoms, panic attacks, insomnia, lack of appetite, compulsive behaviours, and self-destructive behaviours (Boivin et al., 2025; Cianconi et al., 2023; Coffey et al., 2021; Lawrance et al., 2022; Pihkala, 2019; van Valkengoed et al., 2023), which resemble symptoms characteristic of mood, anxiety, and stress disorders (American Psychiatric Association, 2013; Dailianis, 2021). At an extreme level of climate anxiety, suicidal ideation and intention is a possibility (Brailovskaia & Teismann, 2024; Hickman, 2024b).

Indeed, climate anxiety shares several features with symptoms characteristic of various psychological disorders. These include rumination (Hogg et al., 2021; McLaughlin & Nolen-Hoeksema, 2011; Sharp et al., 2015; Yapan et al., 2022), thought suppression (Marks & Hudson, 2024; Yapan et al., 2022), negative metacognition (Clayton & Karazsia, 2020; van der Heiden et al., 2010), hypervigilance (Marks & Hudson, 2024; Sharp et al., 2015), biased information processing (Marks & Hudson, 2024; Norton & Paulus, 2017), and intolerance of uncertainty (Mouguiama-Daouda et al., 2026; Pihkala, 2020a; Rosser, 2019). Importantly, these symptoms are proximal transdiagnostic risk factors, meaning they can help explain the development of related but distinct disorders (Nolen-Hoeksema & Watkins, 2011). This explains the similarities reported between climate anxiety and different types of psychopathologies (e.g., anxiety, mood, trauma, and stress disorders; see Dailianis, 2021). In fact, certain aspects that contribute to climate anxiety could also contribute to the development of diagnosable psychopathological disorders (Thoma et al., 2021). More specific fears about climate change could be considered part of a phobia, or stronger anxiety and depression-related feelings can generalize from being specific to climate change to other domains and therefore be potentially diagnosable as an anxiety or mood disorder.

Because of the similarities between some climate anxiety features and psychological disorders, some scholars have used clinical frameworks to help people with debilitating climate anxiety. An example of such a framework is clinical ecopsychology (Thoma et al., 2021). This approach focuses on the impacts, moderating factors, and pathways that lead to mental health impairments because of ecological issues, as well as in exploring ways to help people afflicted by them. At the same time, clinical ecopsychology acknowledges the potential benefits of climate anxiety and similar reactions. From this perspective, climate anxiety is comprised of a variety of symptoms that lead to distress and impairment, although these symptoms are not yet formally specified. Some scholars argue that using clinical frameworks allows for increasing awareness of negative consequences and allocating resources to prevent and remediate these impairments (Thoma et al., 2021).

Here, it is relevant to differentiate between climate anxiety and domain-free psychological disorders. No existing anxiety theory includes climate anxiety as a subtype of anxiety (Pihkala, 2020a). In fact, some correlational studies have reported non-significant correlations between climate and domain-free anxiety, as well as different nomological networks (e.g., Beckord et al., 2025; Cosh, Williams, et al., 2024), which support the divergent validity of the two constructs. The causal relationship between climate anxiety and domain-free disorders is still unclear, as most studies on this topic have been correlational (Ojala et al., 2021). Climate anxiety may exacerbate pre-existing mental health issues, be one of many sources of anxiety affecting a person, or be someone's main source of psychological distress (Nezlek & Cypryańska, 2024; Pihkala, 2020a).

Despite climate anxiety's potential for functional impairment (which is a common criterium for the classification of psychological disorders, see American Psychiatric Association, 2013), most scholars argue climate anxiety should not be considered a mental health disorder (Boivin et al., 2025; Clayton, 2020; Ojala et al., 2021; van Valkengoed, 2023). As mentioned previously in this chapter, climate anxiety is considered a healthy and reasonable response to climate change (e.g., Crandon, Scott, et al., 2024; Cunsolo et al., 2020; Kurth & Pihkala, 2022), signifying an appropriate appraisal of the ongoing crisis and the need for solutions (Clayton & Crandon, 2024; Pihkala, 2020a).

Furthermore, it can manifest in a variety of ways, some of them adaptive (Kurth & Pihkala, 2022), and classifying it as a disorder overlooks these potential benefits. Accordingly, there is no diagnostic category for climate anxiety in the DSM (American Psychiatric Association, 2013; Thoma et al., 2021), nor criteria for the classification of a pathological level of climate anxiety (Clayton & Crandon, 2024). Still, some scholars maintain that although a diagnostic category is not needed, there are certain benefits to regarding it as such (van Valkengoed, 2023). This includes justifying and incentivizing research into reducing climate anxiety for people who struggle with it, as well as providing psychological help to people in these situations (see also Cosh, Ryan, et al., 2024). Therefore, some cut-offs for levels of clinically-significant levels of climate anxiety impairments have been proposed, which would facilitate screening, monitoring, and timely intervention (Cosh, Williams, et al., 2024; H. Li et al., 2026).

Climate Anxiety Models

As demonstrated in the previous sections, the growing literature examining climate anxiety has resulted in a rich and heterogenous account of the potential responses to climate change across various dimensions and levels. However, to have a unified framework that allows researchers to monitor, predict, and control levels of climate anxiety, it is important to organize these responses into a theory of climate anxiety that holistically represents the various experiences associated with climate anxiety and delineates it from other related constructs (van Valkengoed et al., 2023; Watson et al., 2025). Scholars have proposed explanatory models that describe how climate anxiety emerges, how the different dimensions of climate anxiety interact, and what might determine the adaptiveness of the responses. I will now describe two such models – a theoretical model by Crandon, Scott, et al. (2024) and a process model by Pihkala (2022b). These models integrate the dimensions identified in the previous section and attempt to explain how they can lead to the outcomes listed, thereby providing a more functional account of climate anxiety than the other frameworks (Boivin et al., 2025; Watson et al., 2025).

Theoretical Model of Climate Anxiety and Coping

The theoretical model of climate anxiety and coping (Crandon, Scott, et al., 2024) was developed based on social-ecological, existential, and cognitive theories. The authors of this conceptual model argue that a person experiences climate anxiety following exposure to direct, indirect, or vicarious exposure to climate stressors. This experience raises the salience of existential conflicts about mortality, meaninglessness, and other themes that threaten the core self. Climate anxiety is described as a manifestation of these existential conflicts, a primary alert signal to act on climate change, leading to emotional experiences (pp. 8-9). These emotional experiences are characterized primarily by threat-related emotions of fear, panic, anxiety, and dread, although the chronic nature of climate change may evoke additional emotional reactions such as anger, hopelessness, and grief. People may also experience more positive emotions because of how they choose to react to their more negative emotions. For example, a person may feel optimistic about the future, more motivated to act, and more connected to others because they joined an environmental activism group, or they may feel more at peace after spending some time in nature (Clayton & Crandon, 2024). Depending on contextual aspects (e.g., continued exposure to stressors), cultural norms (e.g., expression or suppression of climate emotions), and individual factors (e.g., ability to tolerate uncertainty and anxiety), these emotional reactions may vary and fluctuate for each person in their salience, the type of emotion experienced, and the duration and intensity of the emotion. Additionally, a person may experience autonomic arousal and physiological symptoms characteristic of anxiety (such as trembling, tight chest, and an inability to concentrate).

These initial reactions, in turn, trigger cognitive and behavioural coping strategies to manage them. Based on transactional coping theory (Lazarus & Folkman, 1987), these strategies may be more problem-focused, by attempting to act upon the threat of climate change itself, mitigating it, or searching for ways to adequately prepare for coming impacts, or more emotion-focused, aiming to relieve the negative emotions the person is experiencing (see also Ojala, 2012). Alternatively, given the chronic and difficult-to-control nature of climate change as a stressor (Clayton, 2020), people may also use strategies focused on activating positive emotions; for example, by changing how the threat is appraised, trusting that powerful societal actors will find solutions, and developing the psychological flexibility to alternate between different climate emotions, also known as meaning-focused coping strategies (see Ojala et al., 2021; Park & Folkman, 1997). Similarly to influencing which emotions are experienced, systemic and individual factors again play a part in influencing which coping strategies are implemented.

People can use a variety of coping strategies, and they can either ease or strengthen the existential conflict the person experiences, leading to more positive or negative outcomes, respectively. For example, adaptive outcomes are more likely for a person who copes with their climate anxiety by seeking ways to change their lifestyle to be more aligned with their environmentally-friendly values and remains hopeful that these small changes are playing a part in wider mitigation efforts; conversely, maladaptive outcomes are more likely for a person who engages in repetitive or exaggerated pessimistic thinking (e.g., rumination and catastrophization) or in behaviours that repress negative emotions (e.g., emotional suppression or substance abuse). Thus, climate anxiety is not considered dysfunctional, but rather an expected and understandable reaction to dire environmental circumstances. What may be considered dysfunctional are the coping strategies people implement. Crandon, Scott, et al. (2024) also adhere to the spectrum view of climate anxiety outcomes, depending on how much the coping responses impair or improve functioning. To maximize adaptive outcomes, the goal should be to promote an understanding of climate anxiety, and more control over the reactions to these emotions.

Recent empirical studies provide support for the structure proposed by the theoretical model of climate anxiety and coping. They have shown that climate anxiety responses can be differentiated between affect-based anxiety responses, which may or may not be clinically significant, and symptom-based responses, which are more closely associated with cognitive, emotional, and functional impairment (Chan, Tam, et al., 2024; Wullenkord et al., 2024). These two types of responses were predicted by different cognitive and sociocultural factors, and they predicted outcomes differently. Moreover, they did not always co-occur – some people experienced negative emotional responses without experiencing any impact on their wellbeing. These results are consistent with the theoretical model, as they showcase how affective responses are a separate phenomenon from different forms of impairment, and they do not inevitably lead to maladaptive (or adaptive) outcomes (Crandon, Scott, et al., 2024).

Additional supporting evidence for the model comes from two network analysis studies examining the temporal sequences between different climate anxiety responses. Affect-based responses precede cognitive-emotional impairments (e.g., difficulty concentrating, sleeping problems, crying spells), the latter of which the authors hypothesized to reduce important psychological resources necessary for daily functioning (Chan, Lin, et al., 2024; Heeren et al., 2023). This reduction in resources, in turn leads to functional and relational impairments. Consistently with the model’s hypothesis (Crandon, Scott, et al., 2024), cognitive-emotional coping responses, in the form of repetitive thinking and ability to control emotions, explain how a person goes from experiencing various climate-related emotions to adaptive or maladaptive functional outcomes.

The Process Model of Eco-anxiety and Ecological Grief

A different theoretical model, the process model of eco-anxiety and ecological grief (Pihkala, 2022b), focuses more on the development of climate anxiety and the process of learning to live with it. This model highlights the distinct phases people go through as their climate anxiety first emerges. This includes two initial phases, *unknowing* and *semiconsciousness*, when a person is still learning about the climate crisis. This is followed by an *awakening*, a phase characterized by a realization of how severe the threat of climate change is, and consequently, feelings of surprise, disorientation, shock, or trauma. This is when the person first confronts the existential questions posed by the climate crisis, which they may choose to face and accept, or avoid and deny.

At this point, the person enters a stage of coping with their climate anxiety, which requires balanced use of three different coping dimensions. These dimensions include some form of problem-focused action, some form of grieving, processing, and accepting of the losses already incurred and of other difficult emotions (e.g., guilt and anger), and some form of emotional distancing and replenishment, either through avoidance of stressors or active self-care. Throughout this prolonged process, there is potential for experiencing stronger forms of anxiety or depression. These may take place when a person neglects any of the three dimensions or focuses too much on any single one. For instance, too strong of a focus on pro-environmental action may lead to a period of burnout, despair, and eco-paralysis, whereas too much avoidance could lead to denial or disavowal of climate change, cognitive dissonance, or feelings of isolation and distress. Oscillations between the three coping dimensions and stronger states of anxiety and depression are considered expected and normal. Similar to the theoretical model of climate anxiety and coping presented before, contextual and individual factors influence the frequency of these oscillations. As people become more skilled in coping with their climate anxiety, they become more able to consciously control these processes.

Once a person has sufficient awareness and control over all three coping dimensions, they begin another long process of personal transformation, as they learn to live within the climate crisis and adjust their values and behaviours to be more environmentally ethical. In this stage, the person still needs to engage in all three coping dimensions, but their mastery over each dimension means they are more able to process different emotions, and self-care is used more often than avoidance strategies. This stage is characterized by a sense of awareness and acceptance of the reality of climate change, one's reactions to it, the role the person has in helping to mitigate it, and an ability to remain functional despite it. Still, stronger anxiety and depression states remain a possibility. Therefore, Pihkala (2022b) acknowledges the potential adaptive and maladaptive outcomes of climate anxiety, depending on how the person uses each of the three coping dimensions.

The State of the Art

To summarise this chapter, I view climate anxiety as a multidimensional phenomenon, encompassing a variety of affective, cognitive, existential, and behavioural responses to climate-change-related stressors, both present and anticipated. Despite the variety of ways climate anxiety may manifest (influenced by multiple interacting moderating factors at various levels), it is typically characterized by threat-related emotions, existential conflict, and cognitive-behavioural responses to minimize the distress associated with them. Some of these responses are adaptive, they contribute to individual and planetary wellbeing, whereas others are impairing and paralysing. As climate change is a chronic stressor, successful adaptation requires a balanced use of a variety of coping responses, which can be accomplished through a prolonged process of adaptation to climate change. Importantly, I agree with other scholars in regarding climate anxiety as a reasonable response to climate change, and not as a psychological disorder;

still, I recognize it may contribute to clinically significant distress and functional impairment.

In this chapter, I identified the variety of terms, descriptions, dimensions, and potential outcomes that scholars have associated with climate anxiety. This was not an exhaustive account of the entirety of studies that focused on conceptualizing climate anxiety, but it showcases how split the literature can be on certain aspects. Some scholars see climate anxiety as primarily a threat-related affective response (e.g., Marczak, Wierzba, et al., 2023; Stewart, 2021), while others have a more comprehensive approach to the various processes involved in this response (e.g., Hepp et al., 2023; Hogg, 2025; Marks & Hudson, 2024). Some see climate anxiety as including both mild and stronger responses (e.g., Hickman, 2024b; Pihkala, 2022c), whereas others focus more on the stronger, more impairing end of climate anxiety responses (e.g., Clayton & Karazsia, 2020; Innocenti et al., 2025). Some consider climate anxiety as a necessary tool for personal transformation and planetary wellbeing (e.g., Kurth & Pihkala, 2022; Verlie, 2019), while others, despite recognizing its benefits, also see it as a threat to personal wellbeing comparable to psychopathologies (e.g., Christodoulou et al., 2024; Cosh, Ryan, et al., 2024). While recent developments have helped gain a better perspective of the breadth of research being conducted, there is a pressing need for integration.

The conceptual definition I present in this chapter is the result of recent efforts to defragment the wide climate anxiety literature via systematic and narrative reviews (e.g., Boivin et al., 2025; Ojala et al., 2021) and collaborative approaches (e.g., Lawrance et al., 2024; Watson et al., 2025). These methods have contributed greatly towards the need for integration, by organizing the literature and helping to identify key areas of debate, where research findings have been unclear so far. For instance, two narrative reviews have examined the association between climate anxiety and psychological wellbeing more closely (Ojala et al., 2021; Pitt et al., 2023). These reviews found initial evidence for an association between higher climate anxiety and lower wellbeing, but studies on this topic have had inconsistent results, potentially because of the variety of study designs and self-report measures used.

Meta-analyses stand out as a useful method to synthesize empirical findings and test specific hypotheses introduced in narrative reviews (Paul & Barari, 2022). By systematically pooling studies that fulfil the same predetermined set of inclusion criteria and weighting them according to their sample size, meta-analyses allow for the calculation of a combined effect size of the association between two variables that is more robust than estimations from single studies. Furthermore, meta-regressions also allow researchers to examine how other variables may influence the association between two variables, which could prompt further research uncovering the impacts of as yet unexplored moderator variables.

In Chapter 3, I present a meta-analytical study examining one of the prevailing inconsistencies in the climate anxiety literature: the association between climate anxiety and psychological wellbeing. This study focused on results from studies using a specific measure of climate anxiety, limiting the variability in assessment methods that could be contributing to the inconsistencies mentioned in narrative reviews (Ojala et al., 2021; Pitt et al., 2023). Moreover, we explored other potential reasons for this heterogeneity in findings, including sample-level characteristics (e.g., gender distribution, environmental identity), publication-level characteristics (e.g., year of publication, publication status), and measure-level characteristics (e.g., number of factors, measure reliability). With this study, I hoped to further clarify the direction and strength of the association between climate anxiety and wellbeing and what factors may influence it, thereby contributing to the integration efforts from previous narrative reviews.

Chapter 3

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The Supplementary Materials for this chapter are available in Appendix C.

A meta-analysis on the relationship between climate anxiety and wellbeing

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Abstract

Climate anxiety refers to the negative emotional reactions that a person can experience in response to climate change irrespective of prior direct experience with it. Research suggests this emotional reaction ranges from successful coping and adaptation to clinical-level psychological impairment. The Climate Change Anxiety Scale (CCAS) was designed to measure a person's level of climate anxiety impairment. However, inconsistent results when testing the relationship between CCAS scores and psychological wellbeing measures have raised questions about the scale's validity and usefulness for assessing climate change's mental health impacts. Our goal was to quantitatively summarise the direction and strength of the correlations between climate anxiety (as indexed by the CCAS) and measures of psychological wellbeing. We identified 25 studies and 60 effect sizes for inclusion, and meta-analytic results indicated a moderate negative correlation between overall CCAS scores and psychological wellbeing (r = -.296, 95% CI [-.360; -.230], $p < .001$). The meta-analytic estimates were consistent across CCAS subscales and diagnosis-specific measures of wellbeing. Multilevel meta-regressions used to estimate the influence of potential moderators indicated that the correlations were stronger when the sample's mean level of environmental identity was higher, and when a measure indicative of mental unwellness was used. We discuss implications for the nature of the relationship between climate anxiety and psychological wellbeing in general, and for the use of the CCAS in clinical and broader contexts.

Keywords: climate change, climate anxiety, climate change anxiety scale, CCAS, psychological wellbeing, meta-analysis

Background

Climate change's effects are being felt across the world (IPCC, 2021). The climate crisis impacts personal and community wellbeing through a variety of pathways, with implications for people's physical and mental health (Berry et al., 2010). One such pathway is climate anxiety, a phenomenon in which people who have not necessarily experienced climate change's impacts firsthand struggle with negative feelings about this problem (Clayton, 2021). Research has suggested that climate-related concern or anxiety has been increasing in the past 10 years (Clayton, 2021; Leiserowitz et al., 2018; Sciberras & Fernando, 2022), with rising accounts of personal experiences with climate anxiety appearing in the media (Pickering & Pickering, 2023; Pihkala, 2020a), clinical settings (Budziszewska & Jonsson, 2022; Seaman, 2016), and scientific literature (Charlson, Ali, Benmarhnia, et al., 2021).

A number of reviews have also been published addressing mental health impacts of climate change, including those focusing on mental health risks (Obradovich et al., 2018), anxiety, worry and grief responses (Ojala et al., 2021), and anxiety reactions (Soutar & Wand, 2022). Despite the growing interest in mental health impacts and climate anxiety, no previous study has attempted to summarise the consequential influence of climate anxiety on people's wellbeing. Here, we report a meta-analysis providing a quantitative summary of the association between climate anxiety and wellbeing focusing on the most widely used measure, the Climate Change Anxiety Scale (CCAS; Clayton & Karazsia, 2020). The increased interest in climate anxiety has sparked an uptick in research on the topic, but this proliferation of information can be confusing, prone to bias, and overwhelming. We therefore aimed to condense the available evidence in a way that is easy to understand for scientists, policy makers, and the general public. We hope that the results from this study help elucidate what climate anxiety is and the impact it can have in a person's daily life. We begin with a review of the extant literature on the topic.

Climate anxiety

Climate anxiety and related concepts, such as climate-change concern and worry, have been operationalized in a variety of similar ways, usually as general emotional-cognitive phenomena (Ojala et al., 2021). In particular, climate anxiety is described as an affective response to environmental circumstances, resembling a stress or anxiety reaction, that can be felt irrespective of direct experience with climate change (Clayton & Karazsia, 2020). It is accompanied by a process of cognitive appraisal (judgments on how dangerous climate change is), repetitive thoughts, and coping/regulation efforts with the goal of reducing the unpleasantness experienced. All in all, climate anxiety can be conceptualized within a trauma, stress or grief framework (Dailianis, 2021), and its symptoms could be associated with different DSM-5 diagnostic categories, such as anxiety, depression, and post-traumatic stress disorder (Clayton & Karazsia, 2020; Pihkala, 2022b). Climate anxiety can also be characterized as a crisis of hope about the future that can include existential doubts and feelings of dread, leading to a reduction in quality of life by impairing functioning in different contexts (e.g., work, education, social life) (Dailianis, 2021).

The mental health outcomes of climate change can range from normative and adaptive responses that lead to psychological flourishing (as discussed further in this section), to acute and dysregulated responses which contribute to the development of major psychopathology (Doherty & Clayton, 2011). Some individuals experience mild climate anxiety, with symptoms manifesting more occasionally, less intensely, and with limited impact on day-to-day functioning. Other individuals experience more extreme emotional consequences when symptoms reach clinical significance and linger for longer periods (Hickman, 2020; Pihkala, 2019). In these extreme cases, personal daily functioning is heavily affected, which makes the person vulnerable to intrusive thoughts, catastrophizing, and emotional bursts of sadness and terror. Indeed, climate anxiety has been empirically linked to symptoms of depression, anxiety, and stress (Helm et al., 2018; Hogg et al., 2021; Schwartz et al., 2023; Searle & Gow, 2010; Stanley, Hogg, et al., 2021), as well as obsessive-compulsive disorders (Jones et al., 2012).

However, climate anxiety is not necessarily dysfunctional or pathological. Authors often caution against mixing maladaptive climate anxiety with "practical" forms of this type of anxiety, and treating climate anxiety as a psychological disorder (Ojala et al., 2021; Pihkala, 2020a, 2022c; Verplanken et al., 2020; Wullenkord et al., 2021). For example, worry and anxiety can be adaptative and comprise healthy reactions to environmental threats, especially when the threat is as serious as climate change. Such emotional reactions can help a person prepare for, adapt to, and mitigate the impacts of future problems (Barlow, 2002), including in the context of climate change (Ojala, 2007). Accordingly, worry about environmental problems has been linked to positive wellbeing indicators, such as reduced frequency of risky behaviours of young people (Hokka et al., 1999), and sense of coherence regarding one's personal future (Anttila et al., 2000). While the difficult feelings climate anxiety provokes can lead to an inability to engage in meaningful pro-environmental action, a form of eco-paralysis (Pihkala, 2018), emotions underlying climate anxiety, such as habitual worrying (Verplanken et al., 2020; Verplanken & Roy, 2013), can be a source of motivation to engage in pro-environmental behaviour (Bright & Eames, 2021; Maran & Begotti, 2021; Ojala et al., 2021; Pihkala, 2022a; Reser et al., 2012; Schwartz et al., 2022). From an existential perspective, anxiety and worry are seen as rational and constructive reactions to threats to important valued objects (oneself, one's family, the natural environment), and a mature way of facing one's responsibilities as a human (Ojala et al., 2021). Worry and anxiety can be hard to cope with, but processing them is an important aspect of psychological adaptation and growth (Ojala, 2005; Pihkala, 2022b). Despite most accounts being of a negative emotional experience, the relationship between climate anxiety and psychological wellbeing is thus not so straightforward.

Different factors may help explain why the association between climate anxiety and wellbeing varies. Personal distance to the effects of climate change and direct personal experiences with its impacts are two of the variables most frequently associated with both climate anxiety (e.g., Bratu et al., 2022; Soutar & Wand, 2022) and affect (e.g., Hackenbracht & Gasper, 2013). Experiencing direct harm from climate change is a vulnerability factor for the development of persistent mental health problems (Clayton, 2021). Worry about climate change arises from a perception that climate change can threaten one's valued objects (Boehnke et al., 1998; Wang et al., 2018). When one perceives climate change to be impacting them or those close to them (micro-worry), they can experience stronger emotional reactions and poorer mental health (Boehnke et al., 1998; Gago & Sá, 2021; Ojala et al., 2021). If, on the other hand, one worries mostly for people far away from them, society, the natural environment as a whole, and the future of the world (macro-worry), one can still experience worry but not the mental health impacts that are sometimes associated with it (Ojala, 2005).

Pro-environmental behaviour is another variable of interest for the association between climate anxiety and wellbeing. It is identified by Pihkala (2022b) as one of the core dimensions of coping and adapting to climate anxiety, and is also listed in psychoeducational resources that focus on helping people deal with feelings of climate anxiety (Australian Psychological Society, n.d.-a, n.d.-b). Individual and collective pro-environmental behaviours have been shown to have several benefits in reducing a person's climate anxiety and improving mental health. Benefits can be mental/emotional (sense of achievement, self and collective agency and efficacy, hope, joy, praise, self-esteem), social (developing friendships, sense of belonging) as well as spiritual, and can comprise the development of new skills (knowledge, experience) and connecting with and protecting nature (Budziszewska & Głód, 2021; Gallay et al., 2022; Gunasiri et al., 2022; Patrick et al., 2022). A particularity of climate change anxiety, however, is that the threat that elicits these feelings cannot be solved by any individual person. Thus, individual's climate mitigation efforts can have the paradoxical effect of exacerbating climate anxiety. The ineffectiveness of individual climate action can lead to feelings of powerlessness, frustration, uncontrollability, burnout, being overwhelmed, and even feelings of depression (Aitken et al., 2011; Budziszewska & Głód, 2021; Heeren et al., 2023; Hoggett & Randall, 2018; Nairn, 2019; Ojala, 2012, 2013; Pihkala, 2022b).

Another factor that might influence the variability in the association between climate anxiety and wellbeing is environmental identity, which reflects a feeling of emotional as well as cognitive connection to the natural environment (Clayton & Karazsia, 2020; Clayton & Opotow, 2003). People with high levels of environmental identity demonstrate greater environmental concern and pro-environmental behaviour, and they can be more attentive to changes in the environment. They may also have stronger emotional reactions and psychopathology symptoms as a result (Dean et al., 2018). Interestingly, research has indicated that higher levels of nature relatedness—a similar trait-like appreciation and understanding of a person's interconnectedness with nature and all living things (Nisbet et al., 2008)—predicted not only increased levels of negative affect, but also increased positive affect following exposure to climate change impacts (Smith et al., 2022). Another study suggested that a pro-environmental self-identity predicted higher levels of eco-distress, while self-related nature relatedness (an internalized identification with nature) predicted less cognitive-emotional impairment related to climate anxiety (Smith et al., 2023). Therefore, environmental identity can function as both a vulnerability and protective factor in this context.

The reviewed literature indicates the importance of climate anxiety, how it can impact people's wellbeing, and the role of personal experience, pro-environmental behaviour, and environmental identity in moderating the association between climate anxiety and wellbeing. We are aware of 6 multi-item measures that capture emotional reactions to climate change or forms of climate change distress: the Climate Change Worry Scale (Stewart, 2021), the Climate Change Anxiety Scale (Clayton & Karazsia, 2020), the Hogg Eco-anxiety Scale (Hogg et al., 2021), the Eco-anxiety Questionnaire (Ágoston, Urbán, et al., 2022), the Climate Change Distress and Impairment Scale (Hepp et al., 2023), and the Inventory of Climate Emotions (Marczak, Wierzba, et al., 2023). Although there are many measures assessing climate-related anxiety, our meta-analysis focused on the first and most widely used measure, which is described next.

The Climate Change Anxiety Scale (CCAS)

The CCAS was developed by Clayton and Karazsia (2020) to assess the extent to which a person's everyday functioning is impaired in a variety of domains as a result of climate change, and whether the impairment achieves clinical relevance—though it is not designed to be used for clinical purposes. The CCAS was developed based on existing literature on the emotional impacts of climate change and personal accounts of climate anxiety available online at the time. Its items were developed from measures of clinical symptoms consistent with descriptions of climate anxiety, mainly rumination and functional impairment. The final measure has 13 items (see Table 3.1) rated on a 5-point Likert-type scale response format. The first eight items correspond to the cognitive-emotional impairment subscale, which focuses on rumination, difficulty sleeping and concentrating, nightmares, and crying (e.g., "I have nightmares about climate change"). The other five items are part of the functional impairment subscale, and focus on the respondent's ability to work, study, and socialize (e.g., "My concerns about climate change interfere with my ability to get work or school assignments done"). A further nine items can be included in the measure, not as aspects of climate anxiety, but as potential correlates. Three items measure the person's direct and indirect experience with climate change (e.g., “I know someone who has been directly affected by climate change”), and the last six are indicative of the person’s pro-environmental behavioural engagement (e.g., “I feel guilty if I waste energy”).

Table 3.1

Subscales and Items of the CCAS (Clayton & Karazsia, 2020)

CCAS item
Cognitive-emotional impairment
1. Thinking about climate change makes it difficult for me to concentrate.
2. Thinking about climate change makes it difficult for me to sleep.
3. I have nightmares about climate change
4. I find myself crying because of climate change
5. I think, “why can't I handle climate change better?”
6. I go away by myself and think about why I feel this way about climate change
7. I write down my thoughts about climate change and analyze them
8. I think, “why do I react to climate change this way?”
Functional impairment
9. My concerns about climate change make it hard for me to have fun with my family or friends.
10. I have problems balancing my concerns about sustainability with the needs of my family.
11. My concerns about climate change interfere with my ability to get work or school assignments done.
12. My concerns about climate change undermine my ability to work to my potential.
13. My friends say I think about climate change too much.
Personal experience
14. I have been directly affected by climate change
15. I know someone who has been directly affected by climate change
16. I have noticed a change in a place that is important to me due to climate change
Pro-environmental behaviour

17. I wish I behaved more sustainably
18. I recycle
19. I turn off lights
20. I try to reduce my behaviors that contribute to climate change
21. I feel guilty if I waste energy
22. I believe I can do something to help address the problem of climate change

Note. Only Items 1 to 13 are included in the CCAS scores.

The CCAS has been used in a variety of countries (e.g., Patrick et al., 2022; Simon et al., 2022), including adapted and translated versions (German, Wullenkord et al., 2021; Italian, Innocenti et al., 2021; French, Mouguiama-Daouda et al., 2022; Polish, Larionow et al., 2022; Spanish, Pérez-Loizaga, 2022; Korean, Jang et al., 2023; and Finnish, Niskanen, 2022). All versions have shown good reliability indices, but factor structures vary, with some studies suggesting a one- (e.g., Innocenti et al., 2021), a two- (e.g., Mouguiama-Daouda et al., 2022; Wullenkord et al., 2021), or even a three-factor structure (Larionow et al., 2022).

In the authors' original scale development studies (Clayton & Karazsia, 2020), both climate anxiety subscales were significantly positively correlated (rs ≥ .47, ps < .001) with a general anxiety and depression measure. These results combined with non-significant correlations between the anxiety and depression measure and the pro-environmental behavioural engagement subscale, supported the scale's concurrent and discriminant validity. The correlations between climate anxiety scales and psychopathology measures were replicated, though with smaller effect sizes, in other studies using the CCAS (e.g., Feather & Williams, 2022b; Wullenkord et al., 2021). Although widely used, the CCAS is not without criticism. Scholars have noted that the CCAS does not capture the entirety of the emotional experiences of climate anxiety (Wullenkord et al., 2021) and it neglects other relevant negative eco-emotions, such as guilt and anger (Ágoston, Urbán, et al., 2022).

Current Study

The conflicting results from studies examining the relationship between climate anxiety and psychological wellbeing highlight the importance of examining how these variables are associated (Paul & Barari, 2022). Exploring the nature of this relationship is important for the implementation of preventive strategies, providing resources to those who need it, planning for future impacts, and preparing adaptation efforts (Clayton, 2020; Kaplan, 2020). Climate change is worsening, so its mental health impacts are also expected to worsen (Hayes et al., 2018). There is also the question of whether climate anxiety is overly pathologized; a better understanding of how this phenomenon is connected with symptoms of psychological disorder would shed light on how clinicians should proceed when faced with patients reporting these issues.

Our goal was to quantitatively assess the direction and strength of the correlation between climate anxiety (as indexed by the CCAS) and psychological wellbeing. We did this by means of a meta-analysis, aggregating studies that have measured climate anxiety with the CCAS and at least one measure of psychological wellbeing. We used Doherty's (2018) definition of wellbeing as not only reflecting a person's mental health and absence of psychiatric conditions and behavioural disorders, but also their ability to flourish. We chose to limit our analyses to climate anxiety as measured by the CCAS because different measures have different underlying definitions of the construct they are measuring (e.g., Ágoston, Urbán, et al., 2022; Hogg et al., 2021; Stewart, 2021). By including only one measure, we hoped to maximize comparability between the included studies, and reduce sources of heterogeneity. We also opted for the CCAS because it was one of the first measures to be developed with the explicit goal of measuring climate anxiety, and therefore it has been used in more studies compared to other measures.

We expected to find non-trivial correlations between CCAS scores and wellbeing measures. We made no assumptions regarding the direction of the relationship because of the inconsistency reported by previous researchers, and the argument for climate anxiety as a form of "practical anxiety", with potential positive consequences for wellbeing (Kurth & Pihkala, 2022). We also tested how different variables may influence the relationship between CCAS scores and wellbeing by including them as moderators. Sample-level personal experience with climate change, pro-environmental behavioural engagement, and environmental identity levels were included due to their potential theoretical implications for both climate anxiety and mental health as reviewed above. These three variables were also included in the initial development study of the CCAS (Clayton & Karazsia, 2020). Additionally, we included other relevant variables as potential moderators, namely sample characteristics (mean age and gender distribution), publication factors (year, publication status, and direction of wellbeing measure used), and some characteristics of the version of the CCAS used (scale reliability and number of factors that emerge).

Method

Inclusion and Exclusion Criteria

We pre-registered this study on the Open Science Framework (https://osf.io/gkxm6/overview). We established three eligibility criteria: (1) studies must have assessed climate anxiety with the CCAS and have included at least one measure of psychological wellbeing, understood as adverse effects on mental health (i.e., anxiety, depression, trauma symptoms, adjustment disorders) and variables indicative of one's ability to flourish (i.e., enjoy positive emotions, trust in the future) (Doherty, 2018); (2) studies had to provide correlation coefficients between the CCAS and wellbeing measure(s), or data that allow their calculation (or authors provided the study data when requested); and (3) studies had to be written in English, Portuguese, or Spanish. We were interested in how climate anxiety and domain-general psychological wellbeing were related, so we included only general measures of psychological wellbeing and excluded any climate- specific measure, such as negative climate emotions. The CCAS is itself a measure of climate-specific negative emotions and would share content overlap with other domain-specific affective measures. No other exclusion criteria were pre-specified. After consulting with a member of the University of Waikato's Ethics committee, we concluded that there was no need to seek ethical approval for the meta-analysis because the data used in this study originated from other studies which had already received ethical approvals, and therefore did not involve direct interaction with human participants (O. Medvedev, personal communication, May 5th, 2023).

Search Strategy

We collected studies through a systematic review of the literature following the guidelines set by the PRISMA 2020 report (Page et al., 2021). We broadened our search to include "grey literature" such as theses and unpublished manuscripts, to reduce the effect of publication bias. We searched the databases EBSCOHost, APA Psychnet, JSTOR, Proquest, Sage journals, SCOPUS, and SSRN in March of 2023. We searched the terms "climate change anxiety scale" or "climate anxiety scale" in the full text and expanded the search to all available databases. We limited the search to studies from 2019 onwards, to reduce the chance of identifying records that preceded the development of the CCAS. We also used a forward citation search for Clayton and Karazsia (2020) on Google Scholar to identify all studies that referenced the original paper in any capacity. We also set up a Google Scholar alert for our search terms to include newly published research. Lastly, we sent out calls for data to psychology organizations from across the world (e.g., American Psychological Association Division 34, Society of Australasian Social Psychologists, Ora Taiao), as well as to individual authors who had published work using the CCAS or who had written about climate anxiety. When we did not receive a response, we followed the original message with a reminder. A list of all sources checked, individuals and organizations contacted, and the messages sent is available in Supplementary Material C1.

Coding procedures

We used Mendeley desktop (version 1.19.8) to import the references of the identified studies. These were then exported to Microsoft Excel and underwent a 3-stage screening process to assess eligibility. The first author worked alone in the first two stages. The first stage involved checking titles and abstracts to remove any studies not in English, Portuguese or Spanish, studies that were not empirical (i.e., review, commentaries), and studies that were not quantitative (e.g., interviews, focus groups). The second stage of screening required accessing the full text and excluding studies that did not use the CCAS. Finally, in the third stage of screening we excluded any studies that did not include any psychological wellbeing measure or did not provide a way to extract correlation coefficients. In the case of the latter, we requested access to the anonymized raw dataset from the original authors. The first author reviewed all the studies independently. The other authors reviewed one half of the studies (26 each) independently. All three authors then compared assessments of study eligibility and discussed any discrepancies until a consensus was reached (inter-rater reliability was 69.23% for R.J.S. and 80.77% for T.L.M.).

The final database was coded in Jamovi (version 2.2.5). We coded study characteristics, namely authors, year of the study, population, country, sampling type, and whether and where it was published. Our outcomes of interest were the Pearson correlation coefficients between the wellbeing measure and the overall CCAS score, as well as the scores for the cognitive and functional impairment subscales. To follow a more consistent and systematic approach for coding the effect sizes, we calculated the correlations directly from the raw data provided by the authors (50 effect sizes from the total of 60 included in the review, as detailed below), and when raw data were unavailable, we extracted the correlations from the articles (10 effect sizes). When the studies reported Spearman's rho correlations (7 effect sizes), we converted them into Pearson's *r* (Rupinski & Dunlap, 1996). We coded the name of the wellbeing measure used and whether it was positive (high scores indicate mental health and wellbeing, such as the SWLS; Diener et al., 1985) or negative (high scores indicate psychopathology, symptoms, or other forms of psychological illbeing, such as the GAD-7; Spitzer et al., 2006). The effect sizes of negative indicators were transformed to the corresponding negative value to reflect their effect on mental health as indicators of mental illbeing, and to avoid overlap with positive indicators in the analyses and plots. Hence, a negative effect size indicates that higher CCAS scores were associated with lower wellbeing scores, and a positive effect size indicates that higher CCAS scores were associated with higher wellbeing scores. If the wellbeing measure was specific to depression/anxiety disorders or symptoms (or had a subscale that was), this correlation was also coded separately.

Correlations between the CCAS scale scores and potential moderators (i.e., personal experience with climate change, pro-environmental behaviour, environmental identity, percentage of female participants in sample, and age) were also coded, as well as each scale's mean score, transformed into comparable percent of the maximum possible (POMP) scores (Cohen et al., 1999). Lastly, we coded potential moderators related to the CCAS, namely its reliability (Cronbach's alpha) and the number of factors that emerged in the original study. Because some studies utilized modified versions of the CCAS (e.g., Cruz & High, 2022; Wullenkord et al., 2021), we included separate columns for sample-specific correlation coefficients for studies with a distinct number of CCAS items. We then compared each correlation with a *z* test (Lenhard & Lenhard, 2004). None of these tests was statistically significant (*z* values ranged from 0 to 0.946, and *p* values from .17 to .50), indicating that the effect sizes did not differ statistically as a function of the number of CCAS items used. Consequently, both columns were collapsed, and in the case of discrepancies, the 13-item CCAS effect sizes were used. Missing data were handled through listwise deletion.

Statistical methods

We performed our statistical analyses in Rstudio software (version 4.2.1; R Core Team, 2022) using distinct packages, specifically the esc (0.5.1; Lüdecke, 2019), meta (6.2-1; Balduzzi et al., 2019), metafor (4.0-0; Viechtbauer, 2010), dmetar (Harrer et al., 2019), and metapower (0.2.2; Griffin, 2020) packages. We based our analysis methodology on current best practices as outlined by Harrer et al. (2022). We performed random effects multilevel meta-analyses for each correlation pairing between CCAS scores (overall, cognitive impairment, and functional impairment) and wellbeing indicator scores (overall, depression-specific measures, and anxiety-specific measures), for a total of nine meta-analyses. The meta-analyses used Fisher's *r*-to-*Z* transformations as the outcome measure, restricted maximum likelihood (REML) model fitting, and Knapp-Hartung adjustments to account for potential low number of included studies. We used the cut-offs set by Richard et al. (2003) for interpreting correlation effect sizes, with .10 indicating a small correlation, .20 a medium, and .30 a strong correlation. Between-study heterogeneity was estimated using tau-squared (τ^2) and I^2 statistics. Publication bias was assessed using contour-enhanced funnel plots and Egger's regression tests. We conducted sensitivity analyses using the dmetar package to find outliers and repeated the meta-analyses without these studies, to test the robustness of the results. Furthermore, we performed influence analyses and used "leave-one-out" forest plots and Baujat plots to visualize each study's contribution to overall effect size and heterogeneity. We also report forest plots of the meta-analyses, which included each study's effect size and weight, as well as the pooled effect size and prediction interval, and subgroup differences (to visualize the effect of discrete moderator variables) when relevant. We report these plots only for the main CCAS-wellbeing meta-analysis, but the code to reproduce the plots across all meta-analyses, as well as to reproduce all the other analyses reported, is available in the OSF page.

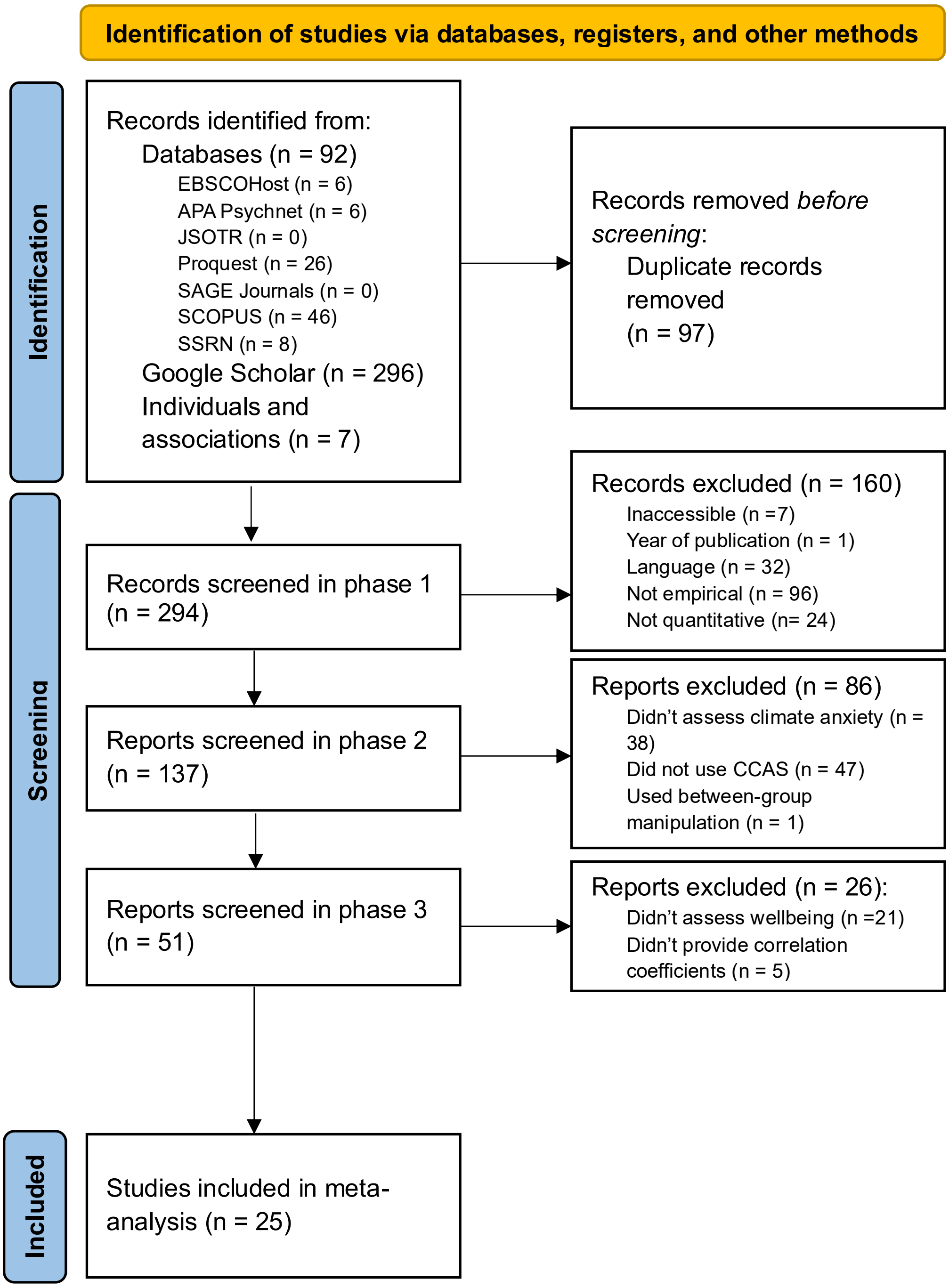
We performed moderation analyses for each potential moderating variable by including them, one at a time, in the multilevel meta-analysis. Those variables that produced statistically significant interactions (*p*-values lower than .05, though we extended this criterion for marginal effects of $p < .10$) were included in a new multi-level model simultaneously, which was compared to the individual two-level meta-regression models with a likelihood ratio test. Finally, we used permutation tests to assess the robustness of the two-level regression models.

Results

Our search identified 395 publications. We removed 97 duplicates, followed by the removal of 160 studies during the first stage of screening, and a further 86 and 27 during the second and third stages of screening, respectively. The review of the resulting 25 studies yielded 60 effect sizes (*k*) from 24 independent samples (*s*) and contained 15,944 participants (*o*). One study (Card et al., 2022) used a subset of data from Closson et al. (in press), which explains why the number of independent samples is lower than the number of included studies. We were able to obtain the raw data for 19 of these studies. The PRISMA flowchart depicting the process of study selection is in Figure 3.1. One study (Thier & Lin, 2022) was eligible but later excluded because it comprised a between-participant manipulation with no pre-intervention measurement.

Figure 3.1

PRISMA Flowchart Describing the Systemic Literature Search



The included studies had participants from 20 countries, of which the U.S.A. was the most represented, with five of the studies (20%) being conducted there. The majority of studies (18, 72%) used a general population sample, though four (16%) used university student samples. Fourteen of the 25 studies (56%) were published in peer-reviewed journals. Those not published in journals included five pre-prints, four theses, and one study that had completed data collection but was in the process of being written. Most studies (22, 88%) used negative measures of wellbeing, with the General Anxiety Disorder (10, 16.7%), the Depression Anxiety and Stress Scale (8, 13.3%), and the Patient Health Questionnaire (7, 11.7%) being the most frequently used. The characteristics of the included studies are given in Table 3.2.

Table 3.2

List of Included Studies and its Characteristics

Study	Population	Country	Publication status	N	Female (%)	Mean age (SD)	Wellbeing measures
Card et al. (2022)[a]	General public	Canada	Unpublished	532	50.00		Subjective social disconnectedness scale
Clayton & Karazsia (2020)	General public	U.S.A.	Published	197 199	40.61 32.16		PHQ-4
Closson et al. (in press)	General public	Canada	Unpublished	1589	48.80		K6
Coelho et al. (2023)	General public	U.S.A.	Unpublished	389	50.30	42.80 (13.60)	DASS GAD-7 CES-D PSS-4
Cruz & High (2022)	General public	U.S.A.	Published	513	61.01	52.20 (18.54)	CES-D-10 STAIS-5
Feather & Williams (2022b)	General public	Australia, New Zealand	Unpublished	401	41.90		K10 GAD-7
Feather & Williams (2022a)	General public	Australia, New Zealand	Published	760	48.00	33.40 (11.90)	MPFI PHQ-4
Hajek & König (2022)	General public	Germany	Published	3091	49.50	46.50 (15.30)	De Jong Gierveld Loneliness Scale Bude & Lantermann (2006)
Heeren et al. (2023)	General public	France, Belgium, Switzerland	Published	778			PSWQ

Study	Population	Country	Publication status	N	Female (%)	Mean age (SD)	Wellbeing measures
Hepp et al. (2023)	Adults	Australia, Canada, Ireland, Italy, Netherlands, New Zealand, South Africa, Ukraine, U.K., U.S.A.	Unpublished	379	50.30	30.72 (9.13)	BDI-II GAD-7 EUROHIS-QOL PANAS
Innocenti et al. (2021)	General public	Italy	Published	135	67.40	33.60 (12.00)	GAD-7 K10
Larionow et al. (2022)	General public	Poland	Published	106	47.20	28.90 (8.49)	PHQ-4 SEQ
Lutz et al. (2023)	University students	Canada	Published	306	78.60	20.15 (3.95)	DASS-21 SPANE SWLS MMILS AHS
Mcbride (2022)	University students High-school students	New Zealand	Unpublished	260 131	84.23 34.40		DASS ERICA
Mouguiama-Daouda et al. (2022)	General public	France, Belgium, Switzerland, Gabon, other French-speaking countries and territories	Published	305	72.13	30.80 (11.32)	BDI-II GAD-7
Niskanen (2022)	General public	Finland	Unpublished	795	60.80		STAI-6
O’Hare & Murray (in press)	General public	Australia	Unpublished	382	70.60	46.40 (14.29)	SFPSS
Papadopoulou (2021)	General public	Greece	Unpublished	98	68.37	24.65 (6.01)	GAD-7
Pérez-Loizaga (2022)	Adolescents	Spain	Unpublished	1252	50.32	14.54 (1.78)	PHQ-4
Ramírez-López et al. (2022)	University students	Mexico	Published	468	66.38	21.60 (1.74)	GAD-7

Study	Population	Country	Publication status	N	Female (%)	Mean age (SD)	Wellbeing measures
Reyes et al. (2021)	Gen Z	Philippines	Published	433	66.51	20.40 (1.60)	MHI-38
Schwartz et al. (2022)	University students	U.S.A.	Published	308	78.80	23.30 (3.84)	GAD-7 PHQ-8
Whitmarsh et al. (2022)	General public	U.K.	Published	1338	53.00	47.10	GAD-7 FFMQ-18
Wilde (2022)	General public	U.S.A.	Unpublished	118			GAD-7
Wullenkord et al. (2021)	General public	Germany	Published	1011	51.14	43.91 (13.97)	PHQ-4 BMBPN

Note. AHS = Adult Hope Scale; BDI = Beck Depression Inventory; BMBPN = Balanced Measure of Basic Psychological Needs; CES-D = Center for Epidemiological Studies – Depression; DASS = Depression Anxiety and Stress Scale; ERICA = Emotion Regulation Index for Children and Adolescents; FFMQ = Five-Facet Mindfulness Questionnaire; GAD = Generalized Anxiety Disorder; K = Kessler Psychological Distress Scale; MHI = Mental Health Inventory; MMILS = Multidimensional Meaning in Life Scale; MPFI = Multidimensional Psychological Flexibility Inventory; PANAS = Positive and Negative Affect Schedule; PHQ = Patient Health Questionnaire; PSS = Perceived Stress Scale; PSWQ = Penn State Worry Questionnaire; SEQ = Safety Experience Questionnaire; SFPSS = Short-Form Perceived Stress Scale; SPANE = Scale of Positive and Negative Experience; STAIS = State - Trait Anxiety Inventory Scale; SWLS = Satisfaction with Life Scale.

[a] Card et al. (2022) uses a sample from wave 3 of Closson et al. (in press).

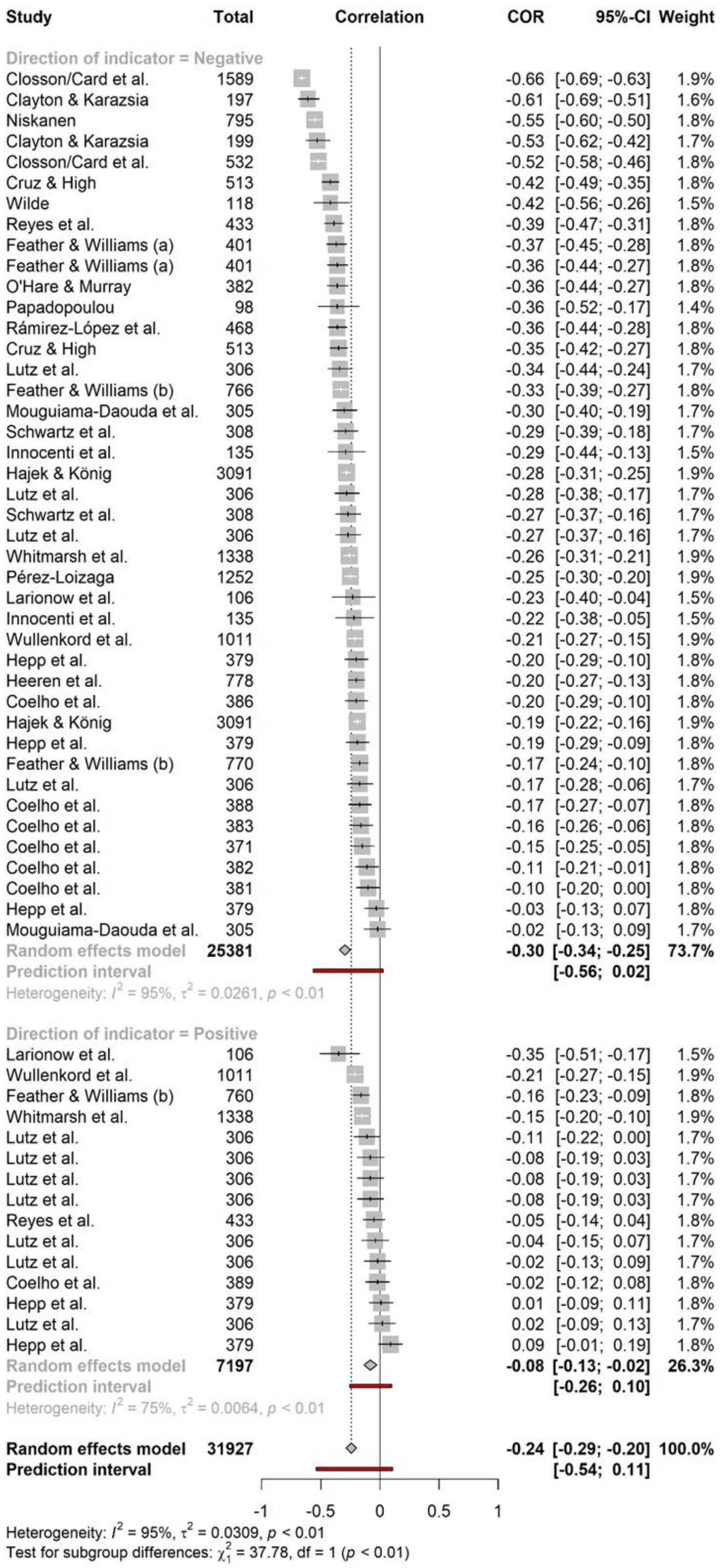
Multilevel and standard meta-analysis

The multilevel meta-analysis of the correlation is a safer estimate of the pooled effect because it accounts for non-independence between the effect sizes (Harrer et al., 2022). On Level 1 we included all effect sizes individually, whereas in Level 2 the effect sizes were aggregated by the sample they originated from. One study did not provide a correlation between the overall CCAS score and a wellbeing indicator (only the correlations between CCAS subscales and the wellbeing indicators; McBride, 2022), resulting in a total of $k = 57$ effect sizes from $s = 23$ independent samples. The random effects multilevel meta-analysis revealed a moderate negative correlation between CCAS and overall wellbeing scores, $r = -.296$, 95% CI [-.360; -.230], $p < .001$, whereby greater levels of climate anxiety are associated with lower levels of wellbeing, and vice-versa. The same pattern of results was found using subscale scores instead of overall CCAS scores, as well as when wellbeing measures were limited to depression- or anxiety-specific measures. The pooled effect sizes ranged from $r = -.302$ (95% CI [-0.366; -0.235], $p < .001$) for the anxiety–wellbeing correlation, to -.227 (95% CI [-.295; -.156], $p < .001$) for the depression–functional impairment correlation. All the results from the multilevel meta-analyses are presented in Supplementary Table C2.

A likelihood ratio test comparing the two-level model to the standard meta-analysis model (with Level 2 heterogeneity constrained to zero) supported the use of the multilevel meta-analysis ($\chi^2_1 = 20.33$, $p < .001$), despite it being more complex. However, we also reported results for the standard meta-analysis. Each study's effect and weight, as well as the pooled effect and prediction interval of the standard meta-analysis are depicted in the forest plot in Figure 3.2 (the results from this analysis are in Supplementary Table C3). Correlations ranged from $r = -.663$ to .088, with 95% being negative. The corresponding prediction interval for the standard meta-analysis, not multilevel, ranged from -.539 to .109, which indicates that although the expected outcome of any future individual study is a negative correlation, it is still possible for positive correlations to occur. We then examined the statistical power of the standard meta-analysis using metapower, which employs the approach proposed by Valentine et al. (2010) and considers the observed effect size, number of studies, and heterogeneity, as well as the average study size by dividing the number of observations *o* by the number of included studies *k* (for a recent application, see Griffin et al., 2021). We used this approach to calculate an *a posteriori* power analysis of this standard random-effects model. The results indicated that a minimum of five studies would be required to detect the observed effect size with 80% statistical power keeping all other parameters the same, and that our standard meta-analysis model included a sufficient number of studies to detect the existence of an effect (power = 1). Our meta-analysis was thus well-powered.

Figure 3.2

Forest Plot of Each Study's Effect Size and Weight, and Pooled Effect Sizes, Aggregated by Direction of Wellbeing Measure



Note. Pooled effect sizes in this figure are from standard meta-analysis, and not the multilevel meta-analysis.

Between-study heterogeneity

The extent to which the effect sizes vary from one another in a meta-analysis is called between-study heterogeneity (Harrer et al., 2022). High levels of heterogeneity can suggest the existence of effect size subgroups in the data with different true effects or the existence of moderators that significantly influence the relationship between the target variables, and hence the pooled effect size should be interpreted cautiously. The outcomes for the multilevel meta-analysis were heterogenous (Q = 1070.62, p < .001), with estimated variance of τ^2 = .010 at the effect-size level, and τ^2 = .022 at the sample level. Levels of I^2 ranged from 83.22% for anxiety-cognitive impairment correlations to 94.58% for the CCAS-wellbeing correlations. Of the total variance for the critical CCAS-wellbeing correlations, 64.87% was due to between-sample heterogeneity, 29.71% was due to within-sample heterogeneity, and 5.42% was attributed to sampling error.

High levels of heterogeneity were observed not only for the multilevel analysis but also for the standard analyses. The heterogeneity observed across our different meta-analyses indicate that the obtained pooled effect sizes may not be the most meaningful representation of how climate anxiety and wellbeing are associated, and one should examine these results together with other indicators that provide a more complete picture of the variety of results reported in and across different studies (such as the range of correlations and the prediction interval). It also highlights the need to test for potential sources of heterogeneity by examining the potential moderating effect of relevant variables, which we explore next.

Moderator analyses

We first considered each potential moderating variable one at a time. These individual moderator analyses identified the direction of the wellbeing measure (β = .170, 95% CI [.105; .234], $p < .001$) and the mean environmental identity score for the study samples ($\beta = .011$, 95% CI [.002; .021], $p = .024$) as significant moderators of the relationship between CCAS scores and wellbeing. The use of negative wellbeing instruments and low sample mean levels of environmental identity were both associated with a stronger correlation between CCAS and outcome variables. None of the other sample characteristics (age, gender, personal experience, and pro-environmental behaviour), CCAS characteristics (reliability and number of factors), or publication factors (year and publication status) had significant moderating effects on the association between overall CCAS and wellbeing scores. However, year of publication and subscale reliability occasionally emerged as statistically significant moderators in the disorder-specific meta-analyses, with older studies and studies featuring more reliable measures displaying stronger correlations. For the CCAS – wellbeing meta-regression, we then introduced direction of wellbeing measure and mean levels of environmental identity simultaneously into the same model ($k = 21$), along with the year of publication, due to it having a marginal effect. This resulting combined model was significant, $F(3, 17) = 12.902$, $p < .001$, and a better representation of the data than any of the individual moderator models, though only the direction of the wellbeing measure retained statistical significance ($\beta = .215$, 95% CI [.116; .314], $p < .001$). Moreover, heterogeneity was still large (76.33%) after including these three moderators together in the model, with 33.07% explained at measure level and 43.26% at sample level. This means that even though the significant moderators included in the model explained a portion of the variance (especially between different samples), the obtained effect sizes were still substantially different from one another. The pooled effects for each subgroup of the wellbeing direction variable are depicted in Figure 3.2. Permutation testing supports the robustness of these results, $F(3, 17) = 20.574$, $p = .001$.

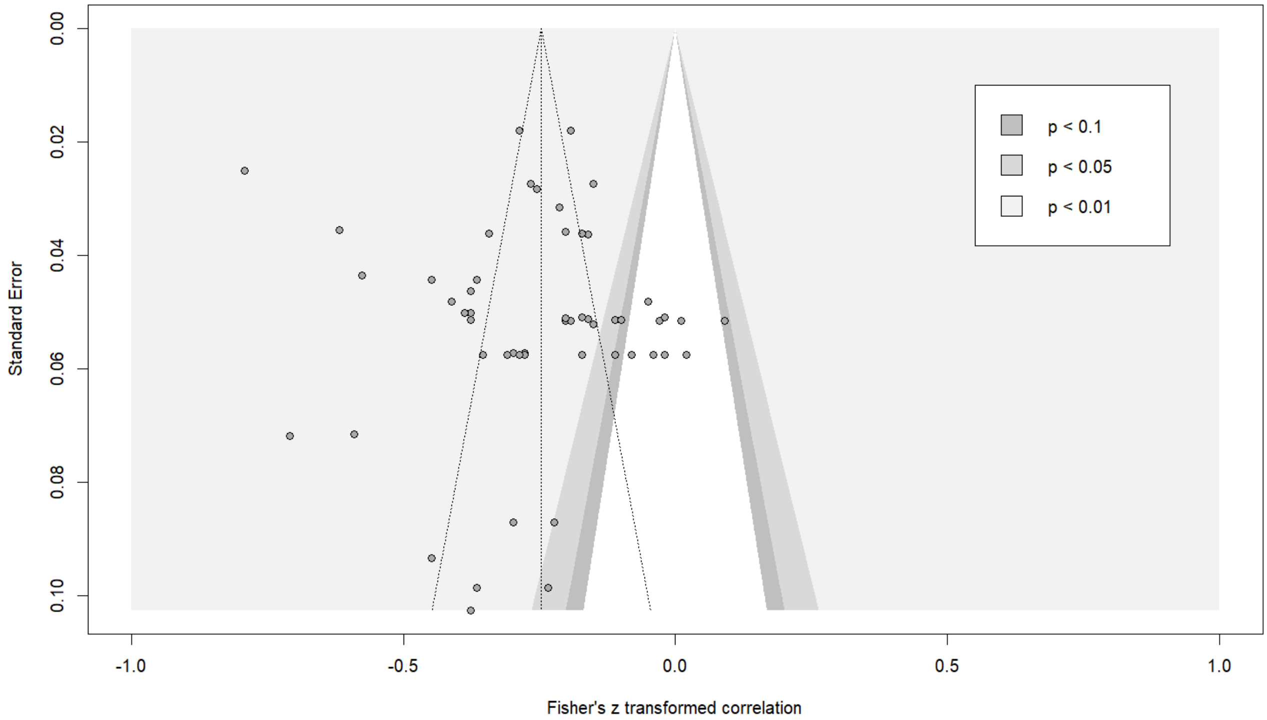
Sensitivity analyses and publication bias

Sensitivity analyses, conducted by removing 19 outlier effect sizes, returned similar results to the 57-effect meta-analysis (r = -.242, 95% CI [-.270; -.215], p < .001, I^2 = 71.7%). Only one effect size (Closson et al., in press) emerged as both an outlier and an influential case (Supplementary Figure C2). This study was retained in the analyses, despite its high relative weight, because its removal did not result in statistically significant changes to either the pooled effect size (Supplementary Figure C3) or the heterogeneity score (Supplementary Figure C4).

Figure 3.3 presents the funnel plot of the standard meta-analysis for the critical CCAS-wellbeing correlations. Egger's test of the intercept suggests the funnel plot is not asymmetrical, and, therefore, is not indicative of publication bias. However, there were some indicators of potential publication bias for the cognitive impairment-wellbeing, functional impairment-wellbeing, and overall CCAS-depression correlations (not shown). Due to the high level of heterogeneity of each meta-analysis, the use of publication bias tests is discouraged, as they cannot provide trustworthy results (Harrer et al., 2022). Therefore, these results are merely indicative of the potential presence of publication bias, and not necessarily confirmation of it. Regardless, publication status did not significantly moderate the relationship between overall climate anxiety levels and wellbeing scores, F(1, 55) = 1.221, p = .27 (with the exception of the meta-analysis between depression measures and cognitive impairment), further supporting the absence of publication bias.

Figure 3.2

Funnel Plot for the CCAS-Wellbeing Correlations



Discussion

Scholars and commentators have noted the health and psychological impacts of the climate crisis (Berry et al., 2010; Pickering & Pickering, 2023). In particular, the extant literature has examined climate-induced anxiety and how it can impact people's wellbeing (Ojala et al., 2021). Contributing to this growing literature, we report a meta-analysis to quantitatively summarise the association of climate anxiety, as assessed by the pioneering and widely used Climate Change Anxiety Scale (CCAS; Clayton & Karazsia, 2020), and psychological wellbeing. We found a moderate negative correlation between climate anxiety scores from the CCAS and psychological wellbeing measures. The direction of the meta-analytical estimate supports the idea of climate anxiety as an impairing cognitive and emotional experience associated with symptoms of psychological disorders (such as depression and anxiety) and other indicators of mental illbeing.

However, the direction of the wellbeing measure used significantly moderated the relationship between the two variables, so that correlations were stronger for negative measures compared to positive measures.

This meta-analysis follows in the footsteps of recent narrative systematic reviews of the emerging climate anxiety literature (e.g., Ojala et al., 2021; Soutar & Wand, 2022), and complements them by quantitatively summarizing results from empirical studies that met our inclusion criteria. We observed similar tendencies in the studies as previous reviews have outlined. Most of the studies we included were cross-sectional, from Western countries, and focusing on the general population. Furthermore, these reviews describe a mixed pattern of results regarding associations between climate anxiety and psychological wellbeing. Despite the wide range of correlations that were included in our study, the large majority were negative. This suggests that though some studies may report practical forms of climate anxiety, the association between climate anxiety (as indexed by the CCAS) and wellbeing, as portrayed in the literature, is predominantly negative.

Climate anxiety is negatively associated with wellbeing

Climate anxiety and related conceptualizations have long been thought of as unpleasant and impairing (Dailianis, 2021; Fritze et al., 2008). People reporting these experiences have described experiencing a variety of physical and psychological symptoms, sometimes intense enough to require psychotherapeutic help (Clayton, 2020; Hickman, 2020; Ogunbode et al., 2023; Soutar & Wand, 2022). The moderate negative correlation we found between climate anxiety and psychological wellbeing supports these earlier observations, and is in line with findings from a narrative review on climate anxiety (Ojala et al., 2021). The observed negative correlation is also consistent with the process model of eco-anxiety and eco-grief (Pihkala, 2022b). When a person becomes aware of climate change as a threat, there is a period of awakening and a feeling of shock and potential trauma that can lead to fundamental beliefs being shattered, major life changes, and the use of maladaptive coping efforts (Doherty & Clayton, 2011). These emotions can either quickly fuel motivation for behaving more sustainably and adapting to this looming threat or trigger a cascade of increasingly more intense periods of stress, anxiety and depression. These stronger negative emotions are always a possible outcome. To avoid it, a person needs to balance acting pro-environmentally, acknowledging the feelings of loss and worry they experience, and consciously disconnecting from climate change to engage in self-care and re-energize (Pihkala, 2022b). Fluctuations between stronger negative states and successful adaptation to climate anxiety are expected and natural.

Studies using measures other than the CCAS to assess forms of climate change distress further support an association between these forms of climate-related-emotions and psychological illbeing. To illustrate, depression, anxiety and stress symptoms correlate positively with measures of eco-anxiety (Hogg et al., 2021; Stanley, Hogg, et al., 2021), climate change distress and impairment (Hepp et al., 2023; Searle & Gow, 2010), climate change worry (Gago & Sá, 2021; Stewart, 2021), and ecological stress (Lutz et al., 2023).

The development method of the CCAS may also contribute to the strength of the pooled effect size we observed. Its items originate from scales that are themselves measures of clinically relevant symptoms (e.g., rumination), and therefore inherently related to psychopathology. There is enough content overlap between the CCAS items and some of the wellbeing measures used in the included studies, namely the most frequently used one, the General Anxiety Disorder (Spitzer et al., 2006), to potentially slant the results of correlational studies towards a stronger relationship (McBride, et al., 2021; Ojala et al., 2021). The direction of the wellbeing measure plays a significant role in supporting this idea. In the CCAS, all items have a negative orientation (see Table 1), making them more similar to items in negative wellbeing measures (e.g., “My concerns about climate change make it hard for me to have fun with my family or friends” and “I couldn't seem to get any enjoyment out of the things I did"; Lovibond & Lovibond, 1995). As a result, stronger correlations are expected in this direction. In fact, many of the included studies used negative wellbeing measures, which may have influenced the results to favour a stronger correlation between CCAS scores and wellbeing. The tendency to use negative measures when assessing wellbeing may thus contribute to an over-pathologizing of climate anxiety. Future studies should include a balanced number of positive and negative measures of wellbeing and compare results between these two types of measures to account for the potential impact of content overlap and avoid skewed results.

The moderating effect observed for the direction of the wellbeing measure could also be related to the specific aspects of wellbeing that each type of measure assesses, and how they may be differently related to climate anxiety. Whereas negative measures from the included studies focus primarily on negative affect, unpleasant thoughts, and uncontrollability (e.g., Lovibond & Lovibond, 1995; Spitzer et al., 2006), positive measures tend to focus on positive affect (e.g., Watson et al., 1988), acceptance (e.g., Medvedev et al., 2018), and satisfaction of psychological needs (e.g., Schmidt et al., 2006; Sheldon & Hilpert, 2012). It is possible that climate anxiety is less related to a lack of these pleasant aspects, as it is associated with the presence of unpleasant characteristics. A longitudinal study found climate concern was significantly associated with psychological distress after a 1-year period, but not to personal wellbeing (McBride et al., 2021). Another study found that environmental worry was directly related to psychopathological symptoms (a negative indicator of wellbeing) but not to life satisfaction (a positive indicator of wellbeing), and that the negative association between environmental worry and life satisfaction was mediated by psychopathological symptoms (Gago & Sá, 2021). Thus, climate anxiety may be indirectly associated with difficulties in psychological flourishing. The negative feelings, thoughts, and inability to regulate them that are hallmark features of climate anxiety could be the bridges that link it to other core features characterized by the absence of positive emotions, such as hopelessness and lower quality of life.

Despite accounting for the effect of some significant moderators, namely wellbeing measure direction, there is still a large portion of heterogeneity in results that is left unexplained. This means we did not include important variables that have an effect on the association between climate anxiety and wellbeing, as they were not measured in the included studies. The process model of climate anxiety highlights three dimensions of adapting to climate anxiety (Pihkala, 2022b). We found pro-environmental behaviour did not act as a moderator of this association, but we did not account for the other two dimensions – self-care and emotional engagement. Self-care corresponds to a healthy form of distancing from engaging with climate change and the negative emotions associated with it, whereas emotional engagement refers to actively processing and working through these emotions. To successfully cope with and adapt to climate anxiety, a person needs a healthy and balanced dose of all three of these dimensions. Thus, imbalances between these facets may contribute to explaining why some studies found stronger associations between climate anxiety and wellbeing.

Another potential moderator variable of interest is pre-existing psychopathology. People with mental health and stress-related disorders can experience more intense symptoms following traumatic events (Dodgen et al., 2016). Coming to grips with climate anxiety can involve feelings of surprise, shock, and even trauma (Kaplan, 2020; Pihkala, 2022c, 2022b). Those who are already struggling with mental health issues will have limited coping resources, and the process of gaining awareness and having to cope with distressing feelings of climate anxiety may push them over the tipping point (Clayton et al., 2021). Hence, a study whose sample included people with pre-existing psychopathology would expect to find stronger associations between climate anxiety and wellbeing variables.

Previous works have also suggested feelings of meaningfulness and positive emotions can influence how climate anxiety and wellbeing outcomes are associated. Climate anxiety can tap into existential questions such as identity, meaning, and death (Budziszewska & Jonsson, 2021; Dailianis, 2021). Existential concerns are a crucial and natural aspect of a person's life, and trying to avoid them can have negative implications for wellbeing. One study examining the link between environmental worry and subjective wellbeing in teenagers using a person-oriented approach found one subgroup of people who experienced high levels of climate anxiety and lower wellbeing, as well as another subgroup that had high levels of climate anxiety but higher wellbeing scores (Ojala, 2005). Three existential emotions – meaningfulness, hope, and anger (as well as trust in environmental organizations) –were stronger and more frequent in the high wellbeing group than on the low wellbeing group, with meaningfulness emerging as the most powerful predictor of differences between the two groups. The author suggested that these emotions could function as buffers to protect from the negative psychological consequences of environmental worry. Clayton et al. (2021) point out that finding a source of personal meaning, such as engaging in religious practices or mindfulness, can help in building personal resilience and even experiencing post-traumatic growth. These positive emotions may thus also explain how some people are able to withstand greater levels of climate anxiety without much impact on their psychological wellbeing.

Implications

Our results have important implications for the study of climate anxiety. First, they reassert the need to include assessments of indirect, vicarious impacts of climate change on psychological wellbeing. Mental health is already overlooked in comparison to the direct impacts, particularly on physical health, in the context of climate change (Charlson, Ali, Augustinavicius, et al., 2021). The World Health Organization (2022) describes mental health as a basic human right, and mental health problems as a major cause of death and disability around the world, which lead to major economic losses for nations. Including measures of climate anxiety in holistic assessments of individual and community-level impacts of climate change, provides knowledge of where resources must be allocated to prevent the exacerbation of symptoms (cf. Hayes & Poland, 2018).

Related to that, the method of assessing climate anxiety needs to be carefully considered due to the implications it may have for results. Self-report questionnaires are often used in these types of studies (Hayes & Poland, 2018) as they are economic and easy to compare, making them ideal for continued monitoring. As our study shows, the specific measures used to assess wellbeing can have important implications for the results and the inferences that can be made from them. To avoid biased interpretations of associations between variables, studies should not rely solely on negative measures of wellbeing and should include a positive (or at least mixed) measure. Some level of content overlap is inevitable, given climate anxiety's similarities to mental health disorders like anxiety and depression (another eco-anxiety measure, the Hogg eco-anxiety scale, was also modelled on a measure of psychopathology, the GAD-7; Hogg et al., 2021). However, an increasing understanding of the specific construct of climate anxiety as something similar but fundamentally unique from other forms of psychological distress, could lead to the development of measures that are better able to differentiate these experiences and provide a clearer picture of how they are associated.

Limitations

Despite its strengths, our meta-analysis has some limitations that warrant discussion. First, we did not perform any formal quality assessment of the included studies (e.g., including only pre-registered studies, with a-priori power analysis). A recent set of meta-analyses on the effects of growth mindset on student's academic achievement revealed that the quality of the studies included can significantly impact the results of the meta-analysis (Macnamara & Burgoyne, 2023). Nineteen of our included studies (76%) were not pre-registered. By not employing these restrictions, we were able to include a larger number of studies and increase the robustness of our results, at the expense of risking the capturing of methodological flaws and biases in the original studies.

Second, because researchers can differ in the methods they used to calculate correlations and in how to report them, we made an effort to collect the raw data from the studies' authors so we could more systematically calculate the effect sizes and minimize this source of error. Nevertheless, we were unable to obtain the raw data for all studies and relied on the original reported values for some. Likewise, many studies did not measure our moderator variables, and very few measured all of them, resulting in smaller sample sizes for our moderator analyses and lower statistical power. This was especially problematic the more specific the meta-analysis was, and when modelling all moderators simultaneously. Third, the high heterogeneity scores precluded any meaningful assessment of publication bias. We thus relied on more informal methods like visually inspecting the funnel plot and moderation analyses.

Fourth, and importantly, despite the well-documented negative association that we also found in our meta-analysis, the correlational nature of current climate anxiety studies does not allow for causal inferences to be made (Ojala et al., 2021). It is as possible for climate anxiety to lead to the development of negative emotions and psychopathological symptoms, as it is for people with psychopathological symptoms to pay more attention to threatening climate information or view it from a more negative perspective (Beevers et al., 2015; MacLeod et al., 1986), or for a third underlying variable to influence both climate anxiety and psychological wellbeing (Ojala et al., 2021). To our knowledge, only one study has so far employed a longitudinal design to investigate the temporal relationship between climate change concern and psychological wellbeing, suggesting that climate concern may cause psychological distress (though it was not related to life satisfaction; McBride et al., 2021). More longitudinal and experimental research on this topic is needed.

While our meta-analyses are unable to provide any new insight about the flow of causation between climate anxiety and psychological wellbeing, it raises questions about whether these variables should be considered separately given their conceptual overlaps. Our results suggest that content overlap may explain why CCAS scores are more strongly associated with measures of psychological illbeing. However, climate anxiety and illbeing should not be seen as the same thing, given the variety of possible outcomes a person experiencing climate anxiety and other climate-change emotions may follow (Doherty & Clayton, 2011). There is thus a discrepancy between how researchers conceptualize climate anxiety theoretically and how they measure it empirically. Disentangling climate anxiety from general psychological wellbeing is important for future research aimed at examining more closely the nature and direction of the relationship between these two constructs (c.f. Hodson, 2021).

Future studies

Future studies could build on our findings by conducting meta-analyses with emerging measures of climate anxiety. The Hogg eco-anxiety scale (Hogg et al., 2021), for example, has seen increased use in this context (Hogg, Stanley, & O'Brien, 2023) and will soon have been used in enough empirical studies to warrant a meta-analysis of its own, as will other emergent measures. This will allow researchers to establish whether the pattern of results we found extends to other measures of climate change anxiety, or if they are specific to the CCAS. Similarly, climate change evokes other emotions alongside anxiety, such as anger, guilt and hope (Ágoston, Csaba, et al., 2022; Pihkala, 2022c). These emotions could be the target of similar meta-analyses as different emotions could have different patterns of association with psychological wellbeing. Lastly, work is needed on identifying which variables can account for the heterogeneity in the association between climate anxiety and psychological wellbeing. We explored some of these variables and proposed potential initial avenues of research (emotional engagement and self-care, pre-existing psychopathology, as well as meaningfulness and positive emotions). The variety of correlational studies that have focused on associations between climate anxiety and numerous other variables is a good indicator of how many possibilities there are in this area of research. It is a matter of systematically testing which of these have a significant moderating effect. Moderating variables may help explain why some people are more vulnerable than others when it comes to the psychopathological outcomes of climate anxiety and may suggest new targets for interventions aimed at limiting the debilitating impacts of climate anxiety. Our study provides an additional contribution to the growing literature investigating the mental health impacts of climate change.

Chapter 4

In the previous chapter, we established the existence of a consistent association between climate change anxiety and domain-free psychological wellbeing. Within the studies that were part of the data collection process, there were several studies that pertained to the development of other climate anxiety measures (e.g., Hepp et al., 2023), or other neighbouring concepts (e.g., Stewart, 2021). Together with the lack of conceptual uniformity observed between studies and the large heterogeneity reported in this meta-analysis, the multiple measures of climate anxiety that exist currently could be contributing to conceptual and methodological fragmentation. The study in this Chapter examines these measures and compares how they measure climate anxiety to how established measures of domain-free psychopathology examine their respective target constructs. We also quantitively examine whether these measures, despite targeting different constructs, capture the same underlying climate anxiety trait, thereby exploring the issue of parsimony in the context of climate anxiety measuring.

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The Supplementary Materials for this chapter are available in Appendix D.

Examining Content Representation and Convergence of Climate Anxiety Measures

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Abstract

We used a mixed-methods approach to examine overlaps across existing climate anxiety scales. We first examined how six scales of climate anxiety represent symptoms associated with domain-free diagnoses of psychopathologies compared to gold-standard scales in the mental health literature. We then analysed correlations between climate anxiety scales and conducted exploratory factor analyses with samples of university students (n = 143) and the general public (n = 305). Climate-related anxiety scales have a higher proportion of items focusing on anxious and depressed mood, and fewer items assessing somatic symptoms compared to domain-free scales. The scales showed strong intercorrelations and loaded onto a single factor, suggesting convergence in how climate-related anxiety has been measured. Future studies could include multiple climate anxiety scales that may differ conceptually and methodologically from one another to ensure wider content representation while minimising overlap and focus on testing incremental validity to achieve a parsimonious and gold-standard measure.

Keywords: climate change, climate anxiety, content representativeness, convergent validity

Introduction

Climate change has important implications for mental health (Clayton et al., 2021; Obradovich et al., 2018). Negative impacts include negative acute stress, feelings of grief and loss, or substance abuse, in the aftermath of extreme or prolonged weather events brought about by changes in climate (Clayton, 2021; Lawrance et al., 2022). Impacts to mental health can also occur even without first-hand experience with climate events, as reactions to the awareness of climate change as a threat (Clayton, 2021). Climate anxiety is one of the terms used to describe these vicarious negative emotional reactions specifically related to the climate crisis (Pihkala, 2024b).

According to a recent theoretical model of climate anxiety (Crandon, Scott, et al., 2024), exposure to continuous direct and indirect triggers (e.g., going through a heatwave, or watching a news piece about the icecaps melting) activate affective responses, mainly persistent worry, anxiety, dread, and despair. These affective responses can involve a wider range of emotions, like irritability, sadness, or frustration, as well as physiological experiences, such as nausea, sweating, or muscle tension (Crandon, Scott, et al., 2024; Dailianis, 2021; Lawrance et al., 2022; van Valkengoed et al., 2023). Climate anxiety can also encompass various unconstructive cognitive appraisal processes and behavioural responses, such as ruminative thought, fatigue, difficulty concentrating, and insomnia (Crandon, Scott, et al., 2024; van Valkengoed et al., 2023). Importantly, climate anxiety is a form of existential anxiety, as the projected impacts of climate change raise questions about the survivability of humankind and about one's own mortality (Budziszewska & Jonsson, 2021; Crandon, Scott, et al., 2024; Dailianis, 2021). The combination of emotional, cognitive, and behavioural responses with how the person addresses this existential conflict contribute to whether their climate anxiety is ultimately adaptive or maladaptive (Crandon, Scott, et al., 2024).

Though climate anxiety is not considered a psychological disorder (see Clayton, 2020), its symptoms can have an impairing effect on a person's daily life (Cosh, Williams, et al., 2024; Crandon, Scott, et al., 2024). Presentations of maladaptive climate anxiety can vary from person to person, both in terms of which symptoms are present and in their intensity (Pihkala, 2019). Some symptoms characteristic of climate anxiety (such as uncertainty, rumination, and sadness) are also typical of different diagnostic categories in the DSM-5, namely anxiety (particularly generalized anxiety disorder), depression, and stress disorders (Dailianis, 2021; Doherty, 2018). The link between climate anxiety and psychopathological symptoms is represented in Pihkala's (2022b) process model of eco-anxiety, which acknowledges that states of intense anxiety and depression are always a possibility when living with climate anxiety, and that people can fluctuate in and out of these states for different periods. This link has also been shown empirically, with a meta-analysis reporting a moderate association between a measure of climate anxiety and domain-free symptoms (unrelated to any specific domain) of psychological disorders (Gago et al., 2024). Thus, while climate anxiety has recently been conceptualized under its own framework (e.g., Crandon, Scott, et al., 2024), it has been linked to frameworks of anxiety, depression, trauma, stress, and grief, both for identifying symptoms and preparing intervention strategies (Dailianis, 2021; Pihkala, 2020a).

The assessment of domain-free symptoms of anxiety, depression, and stress disorders is often performed using self-reported rating scales (Blais & Baer, 2009). Some scales are considered the "gold-standard" for assessing presentations of psychological disorders, and are seen as superior to other measurement alternatives (Cusin et al., 2009). Instruments such as the Beck Anxiety and Depression Inventories (BAI and BDI, respectively; Beck et al., 1988; Beck et al., 1961) or the Hamilton Rating Scales for Anxiety and Depression (HAM-A and HAM-D, respectively; Hamilton, 1959, 1960) have been widely adopted and continuously improved since their inception, resulting in superior reliability and validity indices (Cusin et al., 2009; Marques et al., 2009). Though no scale is free of error, these scales emerge as the most consensual options for clinicians and researchers when assessing people's anxiety, depression, and stress symptoms and are thus the benchmark against which new scales are compared. While some scales of climate anxiety have been developed, none has achieved enough consensus to be considered "gold-standard" (Ramsay et al., 2025).

Clayton and Karazsia (2020) developed the first scale to assess climate change anxiety, the Climate Change Anxiety Scale (CCAS). They focused on the link between climate anxiety and personal wellbeing by assessing how much a person's daily functioning is impaired by climate anxiety. The authors used descriptions of climate anxiety and other emotional responses to climate change in scientific literature and in online blogs to develop items, and also adapted items from clinically validated rumination (Treynor et al., 2003) and functional impairment (Weiss, 2000) scales to determine if the level of impairment associated with climate anxiety could be considered clinically relevant. The final scale has 13 items, divided into two strongly correlated subscales (r = .78 and .84; Clayton & Karazsia, 2020, Study 1 and Study 2, respectively). The cognitive-emotional impairment subscale includes items measuring rumination, difficulty sleeping, crying, and other difficulties. The functional impairment subscale assesses the extent to which climate change is interfering with the person's ability to work or socialize. In the original development study with United States (U.S.) participants, the two subscales correlated positively with experience of climate change impacts, environmental identity, negative emotionality, and symptoms of depression and anxiety.

The CCAS has been translated into over 11 languages and exhibited good internal consistency scores across different studies and populations (Gago et al., 2024). However, its factor structure tends to vary (Hogg et al., 2023), with some studies finding a 3-factor solution (e.g., Larionow et al., 2022) and others reporting a single-factor optimal solution (e.g., Innocenti et al., 2021). A recent meta-analysis suggested a 3-factor structure as the optimal solution for the CCAS (S. Morris et al., 2026). Beyond questions about its factorial structure, the CCAS has also been criticized for failing to capture the entire emotional experience of climate anxiety (Wullenkord et al., 2021) and neglecting other climate-related emotions that tend to co-occur with climate anxiety, such as anger and guilt (Ágoston, Urbán, et al., 2022).

Scholars have since proposed other scales that address these criticisms and to fulfil other considerations. Following a systematic search conducted for a meta-analysis on the association between climate anxiety as measured by the CCAS and wellbeing (see Gago et al., 2024), five other validated scales assessing climate change anxiety or neighbouring phenomena were identified. Due to the timing and inclusion criteria for that meta-analysis and the present study, some scales were left out of our review (see Owczarek et al., 2025; Ramsay et al., 2025; & van Dijk et al., 2025 for more thorough systematic reviews of climate anxiety scales). We outline each of the other five identified scales in chronological order.

The Climate Change Worry Scale (CCWS; Stewart, 2021) was developed to measure the frequency of disturbing, persistent, and repetitive thoughts people experience related to the personal impacts of climate change. This focus on proximal worries (those related to the person or their loved ones) is based on the idea that macro-worries (those related to society or the world as a whole) may not be as reliably associated with individual psychological processes (e.g., repetitive thinking), attitudes, and behaviours (Gago & Sá, 2021; van der Linden, 2017). Stewart (2021) used both factor analysis and Rasch modelling to develop the scale, again using a U.S. sample, resulting in a unidimensional, 10-item scale. CCWS scores were stable across a 2-week period, showing good test-retest reliability, and correlated positively with psychopathology symptoms, trait worry, and fear of weather and storms. A subsequent study showed that the CCWS explained a larger proportion of variance than the CCAS for social wellbeing, the perceived threat of climate change, support for climate policies, and engagement in pro-environmental behaviours (Plohl et al., 2023).

The Hogg Eco-Anxiety Scale (HEAS-13; Hogg et al., 2021) focuses on the broader construct of eco-anxiety, which encompasses not only climate change, but other environmental crises. It was initially modelled on a generalized anxiety disorder scale, and it is the only scale to specify a time frame in the instructions (2 weeks), making it useful for continuous monitoring of eco-anxiety levels (Hogg et al., 2023). The HEAS-13 was developed with Australian and New Zealand samples, and has 13 items assessing the frequency of affective, cognitive, and behavioural symptoms. The 13 items are organized into four positively correlated dimensions: affective symptoms, rumination, behavioural symptoms, and anxiety about personal impacts. The authors split the cross-sectional sample into two random subsamples to run exploratory and confirmatory factor analysis. Correlations between the subscales range from .26 (for rumination and behavioural symptoms subscales in Sample 1) to .75 (for affective and behavioural symptoms in Sample 2. In the original study, all scales correlated positively with psychopathology symptoms and emotional reactivity. The HEAS-13 has already been translated into six languages, including German (Heinzel et al., 2023), French (Mathé et al., 2023), and Portuguese (Sampaio et al., 2023), showing a consistent structure across countries and versions of the scale. A climate-anxiety-specific scale has since been developed as well (Hogg, Stanley, & O'Brien, 2024).

The Eco-Anxiety Questionnaire (EAQ-22; Ágoston, Urbán, et al., 2022) was developed in parallel with two other eco-emotion questionnaires: the Eco-Guilt Questionnaire (EGuiQ-11), and the Ecological Grief Questionnaire (EGriQ-6). Like the HEAS-13, it focuses on broader eco-anxiety instead of just climate change anxiety. The authors differentiated between these eco-emotions based on the variety of emotional responses to climate change reported in the literature. Most of the items from the initial item pool were generated from a qualitative analysis of emotions, beliefs, attitudes, and behaviours about climate change (Ágoston, Csaba, et al., 2022). The author's analysis supported the distinction between the three eco-emotions of interest. Though the EGuiQ-11 and the EGriQ-6 are unidimensional scales, the EAQ-22 has two subscales (habitual ecological worry and negative consequences of eco-anxiety). The questionnaire was developed in Hungary, and the English version of the scale was developed simultaneously with the Hungarian version.

The Climate Change Distress and Impairment Scale (CC-DIS; Hepp et al., 2023), like the CCAS, distinguishes between the emotional impacts of climate change and the functional impairment associated with it. The authors argue that negative emotional reactions to climate change are not necessarily pathological and may be an adaptive response, whereas functional impairment requires greater attention from both a research and clinical perspective. Thus, although in the CCAS both subscales are sometimes considered in the form of a unidimensional climate anxiety scale (e.g., Cruz & High, 2022), in the CC-DIS the distress and impairment subscales are always considered separately. The distress subscale (CCD) measures a broader range of negative emotional reactions to climate change than the cognitive-emotional impairment scale of the CCAS, including items aimed at feelings of anxiety, anger, and sadness. The CC-DIS was developed both in English and German, and its psychometric properties were tested across five studies using samples from various countries including the U.S., the United Kingdom, and Germany. Levels of distress were moderate-to-high across studies and low-to-moderate for impairment. Both subscales were significantly positively correlated (coefficients between .26 for Study 3 and .29 for Study 2).

Lastly, the Inventory of Climate Emotions (ICE; Marczak, Wierzba, et al., 2023) takes an even broader approach to the array of affective responses measured. Contrary to the CC-DIS, this scale is primarily for research purposes, and not for assisting in any clinical diagnosis. It takes a complementary role to other scales focused on cognitive responses to climate change. Development of the ICE took place in Poland. The initial item pool was based on common emotions reported in qualitative studies and a literature review, followed by validation by experts of their relevance, quality, and representativeness of each climate emotion. The final scale has eight climate emotions, each constituting a subscale: anxiety, anger, contempt, enthusiasm, powerlessness, guilt, isolation, and sorrow. Overall, most subscales exhibited excellent internal consistency and correlated as expected with measures for concurrent (climate change perceptions and experiences, emotional reactivity, environmental attitudes, climate action efficacy, and eco-anxiety) and predictive (cognitive-emotional impairment, individual mitigation behaviour, and policy support) validity.

Table 4.1 lists the six validated scales assessing climate change anxiety or neighbouring phenomena we included in this study, as well as the definitions of the psychological constructs measured by each.

Table 4.1

Climate Anxiety Scales, Concepts, and Definitions

Scale	Concept	Definition
EAQ-22	Eco-anxiety	"Concerns about the ecological crisis" (Ágoston, Urbán, et al., 2022, p. 10).
CCWS	Climate Worry	"Troubling, disturbing thoughts that people experience about climate change" (Stewart, 2021, p. 3).
HEAS-13	Eco-anxiety	No definition provided, but participants in Study 1 were given the following definition: "Mental and emotional distress an individual may experience in response to the threat of climate change and global environmental problems" (Hogg et al., 2021, p. 3 – this is the description of eco-anxiety the authors gave to Study 1 participants, and no other explicit definition is provided in their article). "The anxiety people experience in response to salient ecological crises" (Hogg, Stanley, O'Brien, et al., 2024, p. 1)

CCAS	Climate Anxiety	No definition provided but it is described in similar terms to stress, or anxiety response (affective response to environmental stressor with possible links to wellbeing) and depression (but focused on specific cause) (Clayton & Karazsia, 2020, p. 3).
CC-DIS	Climate Change Distress	No definition provided but presented in terms of different types of negative affect related to climate change and the functional impairment associated with the psychological impacts of climate change (Hepp et al., 2023, p. 2).
ICE-Anxiety	Climate Anxiety	"Feeling apprehension, fear and anxiety due to the perceptions that climate change is a serious hindrance and threat to human life" (Marczak, Wierzba, et al., 2023, p. 3). "Feeling hopeless, pessimistic, insecure, and feeling overwhelmed around the perception that the most catastrophic effects of climate change are inevitable" (p. 3).

The Present Research

In the environmental domain, Stern (1992) called the proliferation of scales to assess environmental attitudes an "anarchy of measurement" (p. 279). When reviewing this proliferation of environmental attitude scales, Milfont and Duckitt (2004) cited a similar observation made by McCrae and John (1992) regarding scales developed to assess the five-factor model of personality: "until recently, only a small minority of questionnaire researchers were concerned with the issue of consensus—most preferred to generate new scales rather than organize those already available'' (p. 186). As seen in Table 1, the field of climate anxiety has seen a sharp increase in the number of published scales in the past 5 years that might hinder consensus.

Adding to the issue of scale proliferation, in practice, climate anxiety scales may be capturing the same latent traits – even if treated theoretically distinctly. Strong correlations between scales may be indicative of significant conceptual or measurement overlap (Anvari et al., 2025; Hodson, 2021). In fact, most studies that employ multiple scales of climate anxiety report strong positive correlations between them (Hepp et al., 2023; Hogg, Stanley, & O'Brien, 2023; Mathé et al., 2025; Plohl et al., 2023; C. Smith et al., 2023; Türkarslan et al., 2023; Wittrock, 2021), with correlations ranging from .56 between the CCWS and CCAS functional impairment (C. Smith et al., 2023) to .79 between the CCWS and CCAS cognitive-emotional impairment (Plohl et al., 2023). The only exceptions were a moderate correlation of .45 between the CCWS and the CCAS (Stewart et al., 2023), .31 between the CCWS and HEAS-13 behavioural symptoms, and almost null correlations between the CCD and the CCAS subscales (.10 and -.05; Hepp et al., 2023). Strong correlations between similar scales can be symptomatic of what Hodson (2021) describes as a “construct redundancy fallacy” (p. 586), whereby differently named scales are erroneously assumed to measure different things, but in practice, they capture the same latent trait. This trend goes against the principle of parsimony and discourages replication and scrutiny of theories in favour of using another scale (or creating one) that is more likely to support a researcher’s hypothesis (Hodson, 2021). All in all, both scale proliferation and construct overlap slow down the growth of cumulative knowledge (Anvari et al., 2025).

Recently, three reviews analysed existing scales of climate anxiety, including their development procedures and psychometric properties. Owczarek et al. (2025) highlighted methodological issues with these scales’ development procedures (e.g., using principal components analysis [PCA] instead of exploratory factor analysis [EFA] when assessing latent structures) that could have implications for our understanding of climate anxiety. van Dijk et al. (2025) conducted a content overlap analysis and reported high heterogeneity between scales, with numerous symptoms being assessed only in one of the scales and not in others, reflecting a lack of uniformity in climate anxiety assessment. They also suggest the use of quantitative methods to assess whether they measure the same latent construct. Ramsay et al. (2025) raised concerns about scales’ content validity and the lack of agreement about how to conceptualize climate distress. Importantly, they stated no scale emerged as the most suitable to assess climate anxiety.

Our project started before these recent publications, and our goal was to critically examine and compare how current scales measure climate anxiety and neighbouring phenomena by integrating qualitative and quantitative approaches. To examine the issue of content validity (Ramsay et al., 2025), in Study 1, we qualitatively analysed how the items from the scales in Table 4.1 cover the conceptualization of climate anxiety by Dailianis (2021). We selected this framework because it presents a thorough description of symptoms of climate anxiety that fits with other current models of this phenomenon (e.g., Crandon, Scott, et al., 2024; van Valkengoed et al., 2023). Given how climate anxiety has been conceptually (e.g., Dailianis, 2021) and empirically linked to other psychological disorders (e.g., Gago et al., 2024), we build on van Dijk et al.'s (2025) review by also examining how the climate anxiety items correspond to the DSM-5 (American Psychiatric Association, 2013) diagnostic criteria for generalized anxiety disorder, major depressive disorder, and post-traumatic and acute stress disorder—the disorders most closely associated with available scales examining emotional reactions to climate change. We did the same matching of items to symptoms for five "gold-standard" scales of domain-free anxiety, depression, and stress, and compared how well each type of scale (environmental and domain-free) covered the symptoms identified in the DSM. Our qualitative analysis allowed us to examine the domain representation of symptoms from the available climate anxiety scales, and how it aligns with the domain representation of symptoms in established scales of equivalent psychological disorders.

To examine the issue of quantitative overlap between scales (Anvari et al., 2025; Hodson, 2021; Owczarek et al., 2025; van Dijk et al., 2025), in Study 2, we analysed whether there is evidence of construct and measurement convergence, an indicator of potential construct overlap (see Tam, 2013). We collected new data from an online questionnaire with 129 items from the scales in Table 4.1, obtaining responses from 305 participants from the U.S. and an additional set of responses from 143 university students in New Zealand to strengthen confidence in the original results. We then examined the correlations between the different climate anxiety scales for strong intercorrelations and the existence of a latent common factor (Hodson, 2021; Tam, 2013).

Study 1

Method

For the qualitative analysis, we first selected the diagnostic categories from the DSM-5 (American Psychiatric Association, 2013) that share characteristics with climate anxiety and have been associated with it in the past (Dailianis, 2021). We listed the symptoms identified in the diagnostic criteria for generalized anxiety disorder (GAD), major depressive disorder (MDD), acute stress disorder, and posttraumatic stress disorder (PTSD). We then matched the symptoms and other construct-level characteristics of climate anxiety (as identified by Dailianis, 2021) to these DSM-5 symptoms. For example, “various negative emotions” associated with climate anxiety was matched with “depressive mood” from the diagnostic criteria for MDD, and “overwhelmed” to “inability to control worry” from the GAD criteria. This process allowed us to evaluate the ability of climate anxiety scales to capture symptoms that may evolve into more impairing manifestations of psychopathology (see Chan, Lin, et al., 2024).

We then collected 130 items from the scales listed in Table 4.1 (see Supplementary List D1). We used scales related to other eco-emotions (such as the EGuiQ-11 and the various ICE scales) because these are sometimes linked to the emotional experience of climate anxiety (Crandon, Scott, et al., 2024; Pihkala, 2020a, 2022c). After matching the symptoms of climate anxiety to the DSM-5 symptoms, we matched each item from the various climate anxiety scales to the symptoms of climate anxiety listed in the previous step. In some cases, an item could be considered as relating to more than one symptom, and that item would then be matched to both potential symptoms (e.g., the CCAS item "I have nightmares about climate change" was matched to both sleep disturbances and nightmares as related to intrusive thoughts).

We selected two gold-standard scales of domain-free anxiety and depression, the HAM-A and BAI for anxiety, and the HAM-D and BDI for depression (Cusin et al., 2009; Marques et al., 2009). We could not find a gold-standard scale for domain-free stress disorders, so we used the Depression, Anxiety, and Stress Scales (DASS-21; Lovibond & Lovibond, 1995) because it has a stress scale in addition to scales for anxiety and depression. It has also been used in correlational studies assessing the association between climate anxiety and wellbeing (e.g., Lutz et al., 2023). We listed the symptoms included in each scale and matched them to the DSM-5 symptom categories established previously.

We then examined how the symptoms from the domain-free gold-standard scales matched the DSM-5 criteria; that is, how well these scales covered the full array of symptoms included in the diagnostic criteria for these disorders. This was followed by comparing how well the climate anxiety items covered the domain-free symptoms identified in the DSM-5. We used percentages to quantify the proportion of symptoms from each type of scale (domain-free or climate-focused) that matched each type of symptom from the DSM-5.

Results

A full list of the symptoms identified for each domain and scale as well as the matching between them is available in Supplementary Table D1. We identified a total of 21 symptoms or characteristics of domain-free anxiety, depression, and stress from the DSM.

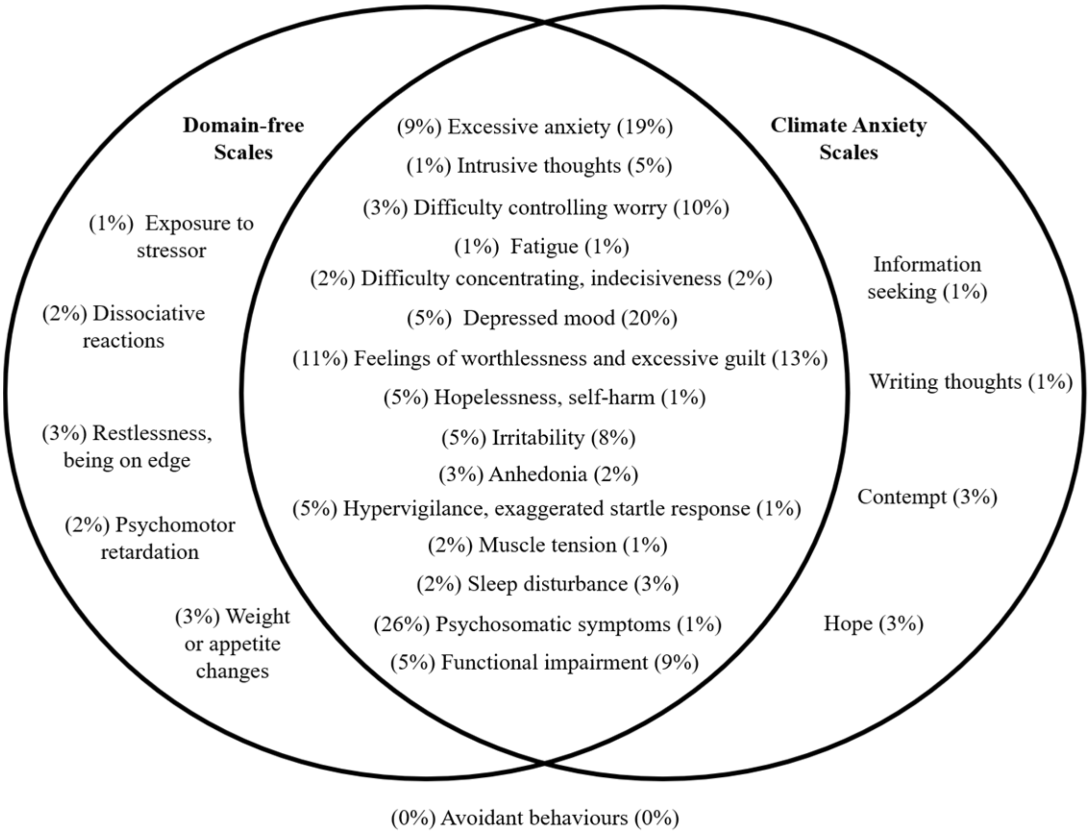
Between all five domain-free scales, 20 of the 21 symptoms were covered by at least one scale; the only exception being avoidant behaviours related to the stressor. However, neither the Beck scales (BDI plus BAI), the Hamilton scales (HAM-D plus HAM-A), nor the DASS-21 covered all the symptoms from the DSM we listed. We identified a total of 87 symptoms assessed by the domain-free scales. The domain-free scales included a large variety of items focused on somatic symptoms (26%), anxious states (9%), depressed mood (5%), and functional impairment in working, socialization, or family life (5%). In contrast, intrusive thoughts (1%), fatigue (1%), and difficulty concentrating and making decisions (2%) were included less often in the domain-free scales. The DASS focused on symptoms experienced in the last 2 weeks, the BAI in the last week, the BDI at present time, and the Hamilton scales did not specify a time frame for reporting symptoms.

Regarding the climate anxiety scales, two of the DSM-5 symptoms (hypervigilance and psychomotor retardation) did not have a corresponding climate anxiety symptom or characteristic. Three additional climate anxiety characteristics (diminished trust in media, politicians, and in the future, existential anxiety, and increased risk for people with strong environmental identities) did not have a corresponding DSM-5 symptom. Of the total 129 items from the eight climate anxiety scales, 24 items (18.6%) corresponded to feelings of excessive anxiety, worry, and distress; the DSM symptom with the greatest number of items associated with it. It was followed by items tapping depressed mood (20%) and items assessing feelings of worthlessness and excessive guilt (13%). Six of the DSM symptoms – avoidant behaviours, exposure to stressor, dissociative reactions, restlessness, psychomotor retardation, and weight or appetite changes – had no corresponding climate anxiety items. While the EAQ-22, EGuiQ-11, and EGriQ-6 covered the greatest number of climate anxiety characteristics (15) and DSM-5 symptoms (11), the CCWS covered the least (five climate anxiety characteristics and three DSM symptoms).

Comparing the distribution of symptoms covered in the domain-free scales to the climate anxiety scales, we observed that the climate anxiety scales have a wider coverage of feelings of excessive anxiety, intrusive thoughts, and difficulty controlling feelings of worry than the domain-free scales. On the other hand, the domain-free scales have a wider coverage of somatic symptoms. Other symptoms that are not as well covered by the climate anxiety scales compared to the domain-free scales include restlessness, hopelessness and self-harm, and weight or appetite changes. Figure 4.1 depicts the coverage of symptoms by both types of scales. Overall, of the 21 identified DSM-5 symptoms, the domain-free scales covered a larger number of categories (20) compared to the climate-related anxiety scales (15).

Figure 4.1

Coverage of Symptoms by Domain-free and Climate Anxiety Scales



Note. Percentages represent the proportion of symptoms from each type of scale that assess the corresponding DSM symptom

Study 2

Method

Participants

General Public Sample. Participants for the first sample were recruited online through Amazon MTurk. They had to be U.S. residents and over 18 years old. We presented the study as a questionnaire about emotional responses to a global issue. The MTurk workers were self-selected and received 2 USD for their participation once their responses were approved.

The data were initially collected for a larger study with the goal of condensing the existing climate anxiety scales into their best fitting items using Rasch methodology, which was preregistered on OSF (Gago et al., 2025a). The desired sample size for that study was 300 participants. No a priori power analysis was conducted for the current study.

We recorded a total of 775 responses, but 470 were excluded to preserve data quality (removing bot, duplicate, and careless respondents). The rules and number of participant exclusions are in Supplementary Table D2. The final sample comprised 305 participants (acceptance rate of 39.35%). Of these participants, 72.13% identified as male, and 84.59% as white. The mean age was 33.5 (*SD* = 9.28). Supplementary Table D3 presents a full description of the sociodemographic characteristics of the sample.

University Student Sample. Participants for the second sample were recruited through the University of Waikato's Introduction to Psychology Research Program. The study was presented as an online study, and students received one course credit for participating. We aimed to collect 300 responses again. We received ethical approval for this second round of data collection from the ALPSS Human Research Ethics Committee under delegated authority by the University of Waikato (#FS2023-50 accepted March 8th, 2024).

We recorded a total of 275 responses but excluded 132 (exclusions detailed in Supplementary Table D2), resulting in a sample of 143 valid responses (acceptance rate of 52.00%). Of these participants, 83.2% identified as female, and 49.7% as New Zealand European. The mean age was 22.1 (*SD* = 7.80). All participants had or were completing a university psychology course. Supplementary Table D4 presents a full description of the sociodemographic characteristics of the sample.

Materials

Participants from both samples completed the same questionnaire. It comprised the items the scales listed in Table 4.1. We included 13 items from the CCAS, 12 from the HEAS-13, 10 from the CCWS, 22 from the EAQ-22, 11 from the EGuiQ-11, 6 from the EGriQ-6, 23 from the CC-DIS, and 32 from the ICE. Items from the HEAS-13 were changed to maintain linguistic and presentation consistency across the scales (e.g., Item 1 "Feeling nervous, anxious or on edge." changed to "I feel nervous, anxious or on edge about climate change and other global environmental problems."). We also assessed all the items from these questionnaires for potential overlaps and removed one item from the HEAS-13 (Item 8 "Difficulty sleeping") that was identical to another item from the CCAS (Item 2 "Thinking about climate change makes it difficult for me to sleep"). The final instrument had 129 items. The participants were asked to rate how much each item applied to them. The response scale was modified to remain uniform for all items, consisting of a 7-point scale anchored at 0 (*Does not apply to me at all*) and 6 (*Applies to me all the time*).

Additionally, the participants completed a short sociodemographic questionnaire to characterize the sample. This asked participants their gender, age, ethnicity, level of education, yearly household income, type of place of residence (rural, town, city), and political orientation.

Procedure

Data collection took place in November of 2023 for the general public sample and in March/April of 2024 for the student sample. The assignment on MTurk contained a short explanation of the task, the amount of time it would take to complete it (15 to 30 minutes), and the monetary reward the person would receive upon completion. In the recruitment website for the student sample, the participant did not receive a description of the task (apart from it being an online questionnaire) but was informed of the course-credit reward they would receive. In both cases, the participant clicked a link to a Qualtrics questionnaire.

The questionnaire first presented the participant with a more detailed informed consent sheet, which they had to accept to proceed. This was followed by the climate anxiety items (and attention checks), presented in a randomized order, and finally the sociodemographic questionnaire. Lastly, we included an information debrief sheet with more details on the overall research project. Upon completion, MTurk participants received a code to type in the MTurk assignment page, so we could match questionnaire responses to MTurk Worker IDs. This was required for the data quality screening process, and any identifying data (such as the code, email, and IP address of the participant) were eliminated after approving the responses according to the criteria described above. Student participants only needed to click a link once they finished the questionnaire, and their unique code was linked with their responses automatically, allowing them to receive course credit.

Analysis

We performed our statistical analyses in Jamovi (The Jamovi project, 2021), using the psych package (2.3.9; Revelle, 2023) for correlational and exploratory factor analysis (EFA) using scale scores. The procedure was the same for both samples. We began by running descriptive statistics for each sample. We then created composite scores for each scale by calculating the mean of their respective items, after reverse coding relevant items (in the CC-DIS). In the case of the CC-DIS or the ICE scales, which only use subscale scores, we included each subscale separately. Some of the other scales, like the CCAS or the HEAS-13, use subscale scores, but there are studies in which the mean score of all items is used (e.g., Hajek & König, 2022; Vecina et al., 2025; respectively). Thus, we used single-scale scores for these measures. This resulted in a total of 16 composite scale scores to be used in our analyses.

To test the convergence between our climate anxiety measures, we used step one of Tam's (2013) three-step analytical approach. This involved analysing the intercorrelations and the existence of a latent common factor between scales. We used Pearson's bivariate product-moment correlations to test intercorrelations. Correlation coefficients higher than .80 can be considered indicative of potential overlap between scales (see Hodson, 2021). While we did not include criterion measures (necessary to judge divergence of scales; Tam, 2013), we nevertheless examined how the 16 scale scores correlate with relevant sociodemographic variables, and whether these correlations follow different patterns for different scales, as a way of comparing their nomological networks. Because correlations between observed measures tend to be underestimated when measurement error is not accounted for (Hodson, 2021), we used latent modelling to provide a methodologically stronger examination of the associations between the different scale scores. As our sample size is small for this analysis, we report our findings tentatively, as complementary to our correlational findings, in the Supplementary Materials (see Supplementary Figure D1).

We used an EFA with principal axis extraction on the 16 composite scale scores to test how they clustered together and whether they can be considered indicators of a common construct. We used eigenvalues, scree plots, and parallel analysis to determine the number of factors to extract. Because factor structures can change with different extraction methods (de Winter & Dodou, 2012), we also examined whether the obtained factor structure was consistent across extraction methods.

Results

Table 4.2 shows the mean values, Shapiro-Wilk test for normality, and the Cronbach's alpha and McDonald's omega of each scale score for both samples. In the general public sample, all scales were negatively skewed, meaning that most people scored highly, whereas in the student sample scores on some scales were positively skewed (e.g., CCAS) while others were negatively skewed (e.g., ICE Anger). Most scales had good internal consistency reliability, except two. The CC-DIS scales did not have good Cronbach's alpha, but they did have better and acceptable McDonald's omega, which could indicate residual covariance between its items, different item loadings, or multidimensionality (Navarro & Foxcroft, 2022), most likely related to the reversed items these scales include. The ICE Contempt scale also did not have good reliability overall, but only for the student sample.

Table 4.2

Descriptive Statistics of Scale Scores

Scale	General Public (*n* = 305)				University Students (*n* = 143)			
	M (SD)	Shapiro-Wilk	α	*ω*	*M (SD)*	Shapiro-Wilk	α	*ω*
Total Score [a]	4.00 (1.153)	.884***	.993	.995	2.11 (0.959)	.990	.985	.988
EAQ-22	4.17 (1.312)	.894***	.978	.978	2.19 (1.104)	.986	.951	.953
EGuiQ-11	4.11 (1.343)	.903***	.961	.961	2.31 (1.362)	.977*	.940	.941
EGriQ-6	4.20 (1.317)	.907***	.919	.919	2.44 (1.349)	.981*	.832	.834
CCWS	4.19 (1.320)	.885***	.957	.958	2.07 (1.321)	.971**	.924	.925
HEAS-13	4.11 (1.405)	.890***	.968	.969	1.53 (1.142)	.944***	.927	.932
CCAS	4.08 (1.492)	.869***	.977	.977	0.71 (0.838)	.774***	.923	.935
CC-DS	3.33 (0.659)	.820***	.660	.831	2.64 (0.806)	.960***	.732	.822
CC-IS	3.16 (0.802)	.788***	.528	.766	1.69 (0.644)	.956***	.284	.703
ICE Anxiety	4.28 (1.349)	.896***	.908	.909	2.82 (1.514)	.978*	.858	.860
ICE Anger	4.30 (1.301)	.900***	.898	.898	3.46 (1.776)	.948***	.936	.936
ICE Contempt	4.07 (1.463)	.905***	.894	.896	1.72 (1.067)	.969**	.583	.598
ICE Enthusiasm	4.19 (1.340)	.910***	.901	.902	2.76 (1.323)	.981*	.851	.854
ICE Powerlessness	4.21 (1.340)	.901***	.895	.896	2.88 (1.472)	.972**	.805	.808
ICE Guilt	4.12 (1.399)	.903***	.900	.900	2.25 (1.444)	.967**	.895	.897
ICE Isolation	4.12 (1.484)	.892***	.922	.922	1.24 (1.169)	.896***	.792	.795
ICE Sorrow	4.23 (1.302)	.909***	.895	.896	3.45 (1.656)	.958***	.907	.909

Note. All scale scores obtained by averaging the items of each scale; α = Cronbach's alpha; *ω* = McDonald's omega.

[a] Average score of all 129 items

* $p < .05$. ** $p < .01$. *** $p < .001$.

The intercorrelations between scales were mostly strong, as shown in Table 4.3. In the general public sample, coefficients ranged from .11 (CC-DS and ICE Contempt) to .97 (EAQ-22 and HEAS-13). All correlations were significant and positive, with the CC-DS exhibiting some moderate correlations with other scales, while all others were strong (Cohen, 1988). The median strength of correlations for this sample was .87. In the university student sample, coefficients ranged from -.08 (ICE Contempt and ICE isolation) to .93 (EAQ-22 and CCWS). Most correlations were again significant, positive, and strong, with the exception of the CC-IS, which exhibited moderate correlations, and the ICE Contempt scale, which had non-significant or weak negative correlations with other scales. The median correlation for this sample was .65. The results for both samples were replicated in the latent models (see Supplementary Table D5). The median strength of the covariation between the scales was .93 for the general sample and .74 for the student sample.

The results of the general public EFA were replicated in the university student sample (Table 4.4). We obtained a two-factor solution in the general public sample and a three-factor solution for the student sample based on parallel analysis. In both samples we obtained a one-factor solution based on eigenvalues and scree plot. Using no rotation for the general public sample, all scales loaded strongly on one factor (ranging from .54 for the CC-DS to .99 for the EAQ) which explained 81.9% of variance. The CC-DS cross-loaded on a second factor, as did the ICE Contempt scale, although negatively. This factor explained 5.2% of variance. For the student sample, all but one scale loaded strongly on the first factor (ranging from .52 for the CC-IS to .97 for the EAQ-22), which explained 64.4% of variance. Three of the scales (HEAS-13, CCAS, and ICE Isolation) cross-loaded onto a second factor explaining 4.9% of variance. The only exception was the ICE Contempt scale, which loaded strongly and positively on another factor, together with the CC-DS which cross-loaded positively on this factor, explaining 4.4% of variance. In either sample, no other solutions were tested because of the non-normal distribution of the data.

The 16 scales had similar patterns of correlations with sociodemographic variables (see Supplementary Tables D6 and D7). In the general public sample, age showed weak negative correlations with most scales, except for the CC-DS, ICE Anger, and ICE Sorrow, which were not significantly related with age. Education was unrelated to most scales, except for CC-DS and CC-IS which had weak positive associations. Income was weakly positively associated with half of the scales, and living in more urban environments was positively associated with 10 scales. Lastly, conservative political orientation was weakly negatively associated only with the CC-IS and ICE Anger scales. In the university student sample, age, level of education, socioeconomic status, and place of residence were not significantly correlated with any climate anxiety scale. Political conservatism was moderately negatively associated with most scales, except for the CC-IS scale (no significant correlation) and the ICE Contempt scale (positive correlation).

Table 4.3

Correlation Matrix of Climate Anxiety Scales

	EAQ-22	EGuiQ-11	EGriQ-6	CCWS	HEAS-13	CCAS	CC-DS	CC-IS	ICE Anx	ICE Ang	ICE Con	ICE Ent	ICE Pow	ICE Gui	ICE Iso	ICE Sor
EAQ-22	—	0.83	0.86	0.93	0.89	0.74	0.84	0.48	0.89	0.81	-0.27	0.62	0.74	0.78	0.66	0.89
EGuiQ-11	0.95	—	0.76	0.83	0.82	0.63	0.74	0.45	0.79	0.74	-0.17	0.63	0.76	0.90	0.60	0.76
EGriQ-6	0.94	0.92	—	0.78	0.76	0.60	0.75	0.35	0.77	0.74	-0.17	0.50	0.61	0.73	0.56	0.81
CCWS	0.97	0.93	0.94	—	0.91	0.77	0.78	0.46	0.89	0.75	-0.30	0.59	0.74	0.78	0.70	0.84
HEAS-13	0.97	0.94	0.93	0.96	—	0.85	0.72	0.49	0.80	0.68	-0.18	0.55	0.67	0.79	0.75	0.76
CCAS	0.93	0.91	0.87	0.91	0.95	—	0.52	0.44	0.63	0.49	-0.09[a]	0.43	0.44	0.60	0.69	0.52
CC-DS	0.55	0.46	0.55	0.59	0.50	0.39	—	0.53	0.74	0.74	-0.08[a]	0.61	0.75	0.70	0.47	0.86
CC-IS	0.75	0.71	0.68	0.73	0.78	0.84	0.40	—	0.43	0.39	0.16[a]	0.44	0.46	0.46	0.26	0.45
ICE Anx	0.95	0.91	0.92	0.95	0.94	0.88	0.58	0.70	—	0.77	-0.32	0.53	0.74	0.74	0.59	0.83
ICE Ang	0.90	0.87	0.87	0.89	0.86	0.77	0.65	0.57	0.88	—	-0.21	0.48	0.71	0.65	0.53	0.76
ICE Con	0.79	0.79	0.73	0.74	0.81	0.85	0.11	0.64	0.72	0.63	—	-0.12[a]	-0.11[a]	-0.13[a]	-0.08[a]	-0.27
ICE Ent	0.89	0.88	0.85	0.87	0.88	0.89	0.44	0.66	0.84	0.80	0.76	—	0.53	0.60	0.38	0.59
ICE Pow	0.92	0.90	0.89	0.90	0.90	0.86	0.51	0.64	0.90	0.87	0.76	0.85	—	0.69	0.47	0.73
ICE Gui	0.93	0.94	0.91	0.92	0.92	0.89	0.48	0.69	0.89	0.83	0.75	0.86	0.87	—	0.55	0.74
ICE Iso	0.93	0.89	0.88	0.91	0.93	0.92	0.44	0.78	0.88	0.81	0.80	0.83	0.87	0.84	—	0.48
ICE Sor	0.92	0.87	0.90	0.91	0.88	0.81	0.61	0.61	0.91	0.88	0.65	0.84	0.86	0.86	0.82	—

Note. Bottom half of the table corresponds to the general public sample, and top half to the university student sample. The median strength of the correlation between the scales was .867 for the general sample and .653 for the student sample. Red-shaded cells indicate correlations stronger than .60, and blue-shaded cells lower.

[a] Not significant at $p < .05$

Table 4.4

Exploratory Factor Analysis of Climate Anxiety Scales

Scale	General Public			University Students			
	Factor		Uniqueness	Factor			Uniqueness
	1	2		1	2	3	
EAQ-22	.991		.017	.972			.047
EGuiQ-11	.960		.076	.897			.191
EGriQ-6	.951		.090	.843			.283
CCWS	.977		.039	.956			.055
HEAS-13	.981		.033	.925	.309		.049
CCAS	.948		.040	.741	.534		.165
CC-DS	.544	.612	.329	.858			.166
CC-IS	.748		.420	.520		.441	.535
ICE Anx	.957		.075	.900			.153
ICE Ang	.898		.126	.813			.304
ICE Con	.799	-.468	.143			.583	.595
ICE Ent	.903		.180	.640			.560
ICE Pow	.929		.136	.792			.309
ICE Gui	.936		.123	.848			.272
ICE Iso	.936		.110	.974	.368		.405
ICE Sor	.916		.121	.892			.120

Note. Factor loadings lower than .300 are not displayed.

Discussion

The field of environmental psychology is teeming with new constructs and questionnaires that purport to describe and assess the negative reactions people can experience in response to climate change. With our first study, we examined how six current climate anxiety scales assess the symptoms of domain-free anxiety compared to the gold-standard scales of the construct. Our qualitative analysis showed that though both types of scales cover most of the symptom categories for generalized anxiety disorder, major depressive disorder, post-traumatic stress disorder, and acute stress disorder, they differed in the depth with which they focused on certain types of symptoms. Furthermore, with our second study, we demonstrated that the six scales of climate anxiety are very strongly intercorrelated and can be subsumed under a common factor, supporting their convergence.

Content Representativeness of Climate Anxiety Scales

For a scale to be considered valid for a particular purpose, there must be a correspondence between the score provided by the scale and the latent construct that the scale claims to quantify (Blais & Baer, 2009; Sireci & Faulkner-Bond, 2014). Evidence of validity includes providing an accurate operational definition of the construct being measured, showing that the items in the test cover the different domains of the construct, and that these items are relevant and appropriately included. A consensual framework for climate anxiety detailing how it should be defined and its subdomains is still lacking (van Dijk et al., 2025). As such, we can only make judgments on the content representativeness of each scale compared to its counterparts both in the environmental domain, and in the general domain.

Between climate anxiety scales, the longest 39-item EAQ, EGriQ, and EGuiQ scales covered the most symptoms, while the shortest scale, the CCWS, covered the least. No scale covered the entirety of climate anxiety (as proposed by Dailianis, 2021) or DSM-5 symptoms. The EAQ-22, HEAS-13, and CC-DIS all had a broader distribution across various climate anxiety symptoms, while the EGuiQ-11, EGriQ-6, and ICE scales focused exclusively on their respective emotional experiences. The CCWS tapped more into worry and anxiety and much less into other emotions and impairments, as is its stated goal (Stewart, 2021). The CCAS focuses on rumination and impairment, as would be expected given the items originate from scales meant to measure these symptoms in other domains (Clayton & Karazsia, 2020). Thus, from a content representativeness perspective, and borrowing from the distinction between emotion- and impairment-based climate anxiety from Chan, Tam, et al. (2024), the CCWS, ICE, EGuiQ-11, and EGriQ6 are more suitable if the focus is to access individuals' emotion-based responses, the CCAS more suitable to assess impairment-based responses, and the EAQ-22, HEAS-13, and CC-DIS provide a more balanced assessment of both types of responses.

Compared to the domain-free scales, the climate anxiety items cover fewer of the DSM symptoms identified and focus more on the experience of states of anxiety and negative emotions such as sadness. When it comes to climate change, there are important distinctions between various threat-related emotions such as concern, worry, anxiety, and terror (Pihkala, 2022c). Concern and worry are less intense emotions (Pihkala, 2020a, 2022c), and can even be associated with pro-environmental adaptive behaviours (Verplanken et al., 2020), having been termed forms of “practical anxiety” (Pihkala, 2020a, p.2). Stronger forms of anxiety or terror, on the other hand, can be more difficult to regulate and may have more harmful impacts on daily functioning (Hickman, 2020). Likewise, sadness can range from adaptive forms of grieving to stronger forms of depression, bereavement-like grief, and frequent and spontaneous crying spells (Hickman, 2020; Pihkala, 2022b, 2022c). In contrast to the environmental domain, domain-free scales are usually used in a clinical setting, to help establish a diagnosis of psychopathology. The explicitly clinical purpose of the domain-free scales means that their focus is on determining whether the anxious or depressed mood is intense and frequent enough to classify as “excessive”. Thus, the approach of the domain-free scales is more categorical. Given the broader contexts in which climate anxiety scales are meant to be used, such as research, risk assessment, as well as clinical settings, there is a need for a dimensional approach, covering the full spectrum between adaptiveness and mal-adaptiveness. This approach allows for a more nuanced differentiation between these distinct emotions, instead of simply differentiating between psychopathological or healthy. This could be reflected in the higher number of items about emotional states in existing scales.

Another important distinction between the two types of scales is that the climate anxiety scales have a much lower proportion of items focused on somatic symptoms, such as headaches, nausea, or sweating, which are not diagnostic criteria for GAD, MDD, or acute stress disorder, but are commonly associated features that support the diagnosis. Over six decades ago, Hamilton (1960) described the somatic symptoms of depression as “characteristically vague and ill defined” (p. 57). Nowadays, the DSM-5 lists some examples of somatic complaints associated with different diagnoses (e.g., bodily aches and pains for MDD, p. 163; sweating, nausea, and diarrhoea for GAD, p. 223; physiological reactivity for PTSD, p. 275). The variety of items in the domain-free scales targeting different forms of somatic symptoms may therefore be a way of casting as wide a net as possible when it comes to identifying potential somatic complaints. However, the climate anxiety scales do not follow this approach. Out of all 129 items, only one focused on somatic symptoms (CC-DIS item 18: “When I think about climate change, I get a headache or stomachache”). Chan et al. (2024) highlight that neither a scale assessing affect-based climate anxiety (Ogunbode et al., 2022), nor the impairment-based CCAS capture physiological reactions of climate anxiety. Physiological symptoms have been featured in working definitions for both climate anxiety (Climate Psychology Alliance, 2022; Crandon, Scott, et al., 2024) and eco-anxiety (van Valkengoed et al., 2023), highlighted as possible manifestations of psychological stress responses to environmental issues (Doherty, 2018), and reported by people experiencing climate anxiety (Coffey et al., 2021; Gibson et al., 2019; Pitron et al., 2024; Verlie, 2021). Given the similarities in how the two types of scales cover the remaining symptoms, this stands out as the main difference regarding content representativeness between domain-free and climate anxiety scales. The clinical nature of the domain-free scales might again explain this disparity, as somatic symptoms are more associated with physical health.

Finally, compared to the domain-free scales, there were more symptoms that had no representation in the climate anxiety items, such as restlessness, psychomotor retardation, or changes in weight or appetite. Though these symptoms are not often reported in cases of climate anxiety, there are some instances when they are mentioned as a potential occurrence (see Dailianis, 2021; Pihkala, 2019). Notwithstanding the relative rarity of these symptoms, the similarities between presentations of climate anxiety and those of anxiety and depressive disorders may warrant additional attention being paid to these symptoms within the environmental domain.

Measure Convergence of Climate Anxiety Scales

Another indication of the construct validity of a scale is whether instruments that purport to assess the same underlying construct obtain strongly associated results, also known as convergent validity (Brown, 2006). Study 2 shows that 16 scales of climate anxiety and neighbouring constructs are strongly intercorrelated, with many exceeding what has been considered expected for unique constructs (Hodson, 2021). Our results show that across both samples, almost all the climate anxiety scales loaded onto a single factor, demonstrating convergence (Tam, 2013). The strong loadings indicate that despite having non-overlapping sets of items assessing different aspects of climate anxiety (cf. van Dijk et al., 2025), all scales could be tapping into a common climate anxiety latent factor. This is supported by the very high covariances observed between the latent factors, which was the case for most of the scales we examined. The presence of Heywood cases in our results (standardized association estimates that fall outside of the possible range, such as covariations between factors that are higher than 1), suggests that the model could have been misspecified (Brown, 2006), which in this situation is likely due to high multicollinearities or redundancy between indicators in the latent model, which further indicates that the scale scores are extremely similar or overlapping.

The only scales that did not load consistently onto the main factor and had weaker associations with the others were the CC-DIS and the contempt scale of the ICE. The CC-DIS is the only questionnaire which includes reverse-coded items, assessing the absence of emotional and functional impairments associated with climate change. Similarly, the

ICE Contempt scale focuses on feelings of indifference, boredom, and frustration over the exaggerated attention paid towards climate change. The results we obtained may be due to a method effect, related to the negative or inverse wording of the items in relation to the others, or reflecting climate change scepticism or indifference.

However, it is interesting that the reverse-coded and contempt items still loaded onto the main climate anxiety factor and correlated strongly with the other scales in the general public sample, but that was not the case for the student sample, where the associations between the contempt scale and the rest were negative. Overall, these two scales include items representing a perspective regarding climate change that is opposite to that of the other items. Through this perspective, the impacts of climate change are minimized, which can be considered a form of interpretive or implicatory denial (Wullenkord & Reese, 2021). Nevertheless, there is the possibility that these reactions are also manifestations of climate anxiety, in the form of self-protective denial strategies (Dodds, 2021; Wullenkord & Reese, 2021). PTSD and acute stress disorders, which have been argued to be similar to climate anxiety (Dailianis, 2021), both include the avoidance of internal and external reminders of the distressing event (American Psychiatric Association, 2013). Pihkala (2022b) argues that after an initial acknowledgment of climate change, distancing, disavowal, and denial are important parts of the process of adapting to eco-anxiety, in the same way as pro-environmental action and grieving are. It could be that some people are endorsing the contempt items as a form of self-protective denial, whereas others endorse them for ideological reasons, as they do not believe climate change is a real issue with severe implications for the world.

Although Study 2 shows the 16 measures of climate anxiety we included are convergent, it does not yet mean these scales are necessarily equivalent or redundant. While sociodemographic variables are not ideal criterion variables (see Tam, 2013), they do show that the scales we included in the study may have slightly different nomological networks, meaning they might also diverge regarding how they relate to important antecedents (e.g., exposure to extreme weather events) and outcomes (e.g., mental health, pro-environmental behaviour) of climate anxiety. Furthermore, different scales could also identify different subgroups of climate anxiety presentations. Using the CCAS and other emotion-based climate anxiety measures, both Chan, Tam, et al. (2024) and Wullenkord et al. (2024) found different profiles of climate anxiety experiences, with different combinations of emotion and impairment symptoms. While convergent, different climate anxiety scales could reveal other subgroups, by themselves or when combined. For example, including the ICE with other more impairment-focused scales, such as the CCAS, could reveal whether certain eco-emotions are consistently associated with impairment, or if there are cases where they can be adaptive.

Implications

Altogether, our findings support Ramsay et al.'s (2025) and van Dijk et al.'s (2025) conclusion that the lack of consensus on how to conceptualize climate anxiety could be contributing to a lack of parsimony and fragmentation of the field (Anvari et al., 2025). We highlight some recommendations we believe might help prevent further fragmentation and promote parsimony in climate anxiety measurement. First, to maximize content validity, researchers developing or refining scales should not only clearly delineate the construct their scale is measuring and identify the subdomains or symptoms of that construct (Sireci & Faulkner-Bond, 2014), but also explain how their scale differs theoretically and methodologically from others. This could include highlighting how their scale covers different aspects of climate anxiety to existing scales (e.g., the ICE examining different eco-emotions) or uses a new analytical approach in scale development (e.g., the CCWS using Rasch modelling).

Second, authors could engage experts in the field to evaluate content representativeness based on the proposed conceptualization and purpose of the scale

(Sireci & Faulkner-Bond, 2014). This would help ensure wider content representation and the suitability and relevance of items. Involving people self-identified and clinically identified with high climate anxiety, via interviews or focus groups, could also help make sure less discussed or rarer presentations of climate anxiety (such as restlessness, psychomotor retardation, or appetite changes) are also represented in the scales.

Third, studies measuring climate anxiety could employ more than one scale, if feasible. This would not only broaden the number of symptoms one can capture (e.g., including an emotion-based and an impairment-based scale), but importantly, examine how the different scales are associated with relevant criterion variables, such as wellbeing, pro-environmental behaviour, or pro-environmental orientations (see Lutz, 2023) and help establish divergent and incremental validity, two key criteria to judge whether two scales overlap (Tam, 2013). If two scales correlate similarly with criterion variables, but one explains a higher proportion of variance than the other for key outcomes (and this is replicated in different populations), then that scale can be recommended as the most suitable choice out of the two. This ongoing validation process is critical to eventually achieve a gold-standard climate anxiety scale (Cusin et al., 2009).

As we conducted this study, we became aware of five other scales of psychological reactions to climate change: the Environmental Worry Index-11 (EWI; Oguntayo et al., 2023), the Situated Assessment Method for Climate Anxiety Measurement (SAM^2 CAM; Hill-Harding et al., 2024), the Solastalgia Scale (Batool & Batool, 2024), the Domain-Specific Climate Change Distress Scale (DCCDS; Weiß et al., 2024), and the French Eco-Anxiety Scale (EMEA; Jalin et al., 2025). The SAM^2 CAM, EWI, and the DCCDS focus on original specific conceptualizations of climate anxiety, while the developers of the EMEA used qualitative interviews with eco-anxious participants to develop their item pool. Some items touched upon aspects not assessed by existing scales (e.g., existential aspects in the DCCDS, or appetite changes in the EMEA). The developers of the

Solastalgia Scale used expert focus groups to create the item pool. All but one scale (the Solastalgia Scale) was tested for convergent and discriminant validity. Only the DCCDS has been examined for incremental validity against the CCAS. Applying the recommendations we described could help curb the trend of fragmentation, assist developing psychometrically stronger scales, and promote parsimony.

Limitations

One limitation of this study is the quality of the data collected via MTurk. Rosellini and Brown (2021) emphasize the need to screen for careless and biased responding in both undergraduate and MTurk samples and point out that there are studies showing that the quality of MTurk responses is worsening over time. The high exclusion rates in both samples suggests an abundance of low-quality responses that were screened out. Alternatively, the criteria we used for determining the quality of a response, particularly the response pairings, the main reason for rejection (39% in either sample), may have been overly conservative, leading to the exclusion of good quality data and inflating the exclusion rate. Our study design could have contributed to participants failing these attention checks (e.g., due to boredom or tiredness), though other studies assessing scale overlap also use long and repetitive questionnaires (e.g., Tam, 2013).

Even in the final dataset, there are still aspects of the data that raise suspicions over its quality. To illustrate, the reverse-coded items had negative item-total correlations, even after reversing their score. This could indicate that participants were responding similarly high to all items, even when they reflected the absence of climate anxiety. Furthermore, political orientation was not significantly correlated with total climate anxiety scores in the general public sample. A meta-analysis on the association between political ideology and environmental concern, a required precondition for more personal climate worries (van der Linden, 2017), found a substantial positive association between these variables (Cruz, 2017). Individuals on the conservative side of the political spectrum tend to have lower levels of environmentalism (Milfont et al., 2018), environmental concern (W. Poortinga et al., 2019), and environmental values (Sargisson et al., 2020), particularly in the U.S. (McCright et al., 2016). The absence of this association in our data from U.S. participants again point towards the possibility of careless responding.

Notwithstanding these potential issues, our extensive exclusion criteria worked to remove what was likely to be poor quality data, leaving just those participants who fulfilled all of our conditions. Moreover, the results obtained were very similar for both samples, which reinforces our confidence in the results. It is still worth noting that neither of our samples are representative of the general population, limiting the generalizability of our findings. Additional replications of this study would be beneficial to examine how consistent these results are, but there is no indication from our two studies of major disparities that would threaten the validity of our conclusions (Clarke et al., 2024).

Conclusion

Our examination of existing scales of climate anxiety raises important questions about the current state of the field. The items of these scales capture many of the symptoms of anxiety, depression, and stress disorders, but differ from gold-standard, domain-free scales of anxiety in the weight given to certain symptom types, namely affective states and psychosomatic complaints. Furthermore, the extremely high associations between the various scales suggest that even though they were designed with the aim of measuring distinct constructs, they may be capturing the same latent phenomenon. Therefore, to eventually have a gold-standard climate anxiety scale, more direct comparisons between scales are needed, regarding both their content and how they relate to other constructs.

Chapter 5

The two studies in Chapter 4 examined existing measures of climate anxiety and neighbouring constructs, showing that even though they target different dimensions and features of the climate anxiety response, they still capture the same underlying trait. Therefore, to minimize fragmentation of the literature and according to the principle of parsimony, these measures could be integrated into a single scale that not only covers all dimensions of climate anxiety but also surpass existing measures' performance in predicting key outcomes, such as wellbeing. With these goals in mind, in the present study, we use Rasch methodology, a psychometric approach that captures the target construct in a continuous unidimensional trait scale and can be used to characterize questionnaire items and its respondents independently of one another (De Ayala, 2019), to develop a consolidated climate anxiety measure that surpasses existing measures' content representation and predictive power.

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The Supplementary Materials for this chapter are available in Appendix E.

Consolidating Climate Anxiety Scales Using Rasch Modelling

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Abstract

Despite being an important mental health consequence of climate change, climate anxiety assessment has been fragmented. Reviews of measures of climate anxiety raise concerns about content and convergent validity. We aimed to select the best functioning items from current climate anxiety measures to develop a condensed scale using Rasch methodology. We used a mixed-method approach across three studies. First, we pooled items from six measures of climate anxiety and neighbouring phenomena and used Rasch modelling to retain items that followed model assumptions in general public (N = 305) and university student (N = 143) samples. We then surveyed (N = 31) and interviewed (N = 12) clinicians and researchers about the relevance of the selected items and suitability of the scale for their professional practice. Finally, we tested the structure and validity of the retained items (N = 341). Of the 129 initial pooled items, we retained 22 that representatively cover the full scope of climate anxiety experience according to the theoretical model of climate anxiety. These items followed Rasch model assumptions and were deemed relevant by the expert participants. The candidate items exhibited good convergent and discriminant validity but did not predict wellbeing outcomes over and above an existing measure of eco-anxiety. We conclude that while our scale provides a useful representative measure of different climate anxiety presentations, its lack of incremental validity means it does not justify its existence as a new scale, and existing scales should be further validated.

Keywords: climate anxiety, mixed-methods, questionnaire, Rasch

The consequences of climate change extend beyond the observable impacts to the natural environment and people's physical health (Berry et al., 2010; Intergovernmental Panel on Climate Change [IPCC], 2023). Climate change has psychological consequences (see, e.g., Doherty & Clayton, 2011), particularly affecting people's mental health and wellbeing (Obradovich et al., 2018). One psychological consequence of climate change is climate anxiety (Clayton, 2021), which describes a broad range of negative emotions, cognitions, and behaviours related to the impact of climate change (Clayton & Karazsia, 2020; Coffey et al., 2021).

Climate anxiety can take the form of a stress or anxiety response, and is characterized by a crisis of hope regarding the future, feelings of uncertainty, sadness, powerlessness, and overwhelm, as well as rumination, isolation, and existential doubts, among various other manifestations typically associated with conceptualizations of trauma, stress, and grief (Dailianis, 2021). More specifically, climate anxiety is seen as a form of eco-anxiety specific to anthropogenic climate change (Pihkala, 2020a), which can occur even in the absence of direct impacts of climate change and can have implications for a person's ability to function and flourish in their everyday life. Accordingly, climate anxiety can have negative, sometimes serious, consequences for a person's mental health (Gago et al., 2024; Pihkala, 2019). However, it is worth noting that it is not a psychological disorder (Pihkala, 2020a), as it can also lead to positive, adaptive outcomes, such as increased engagement in pro-environmental behaviours and deeper existential reflection of one's responsibilities towards our planet (see Ojala et al., 2021; Verplanken et al., 2020).

Accurate and valid assessment of climate anxiety is thus important for examining the prevalence of climate anxiety, its correlates, and understanding which groups are more vulnerable and how to help them (Owczarek et al., 2025; Ramsay et al., 2025). Various scales have been developed to measure climate anxiety and other related emotional reactions across a variety of contexts (for reviews, see Owczarek et al., 2025; Ramsay et al., 2025; van Dijk et al., 2025). However, there is currently a lack of consensus regarding how climate anxiety should be conceptualized. This is reflected in the poor content validity of existing scales (Ramsay et al., 2025), heterogeneity in the dimensions captured by each scale (Owczarek et al., 2025), and limited overlap in content between scales (van Dijk et al., 2025).

Accordingly, there is no definitive answer as to which scale is considered the gold-standard climate anxiety measure (Ramsay et al., 2025). The methodological challenges which can bias conclusions (e.g., inappropriate sampling, poor item pools, and improper use of data reduction techniques) and huge variability in conceptualizations and methods contribute to a fragmentation of the field (Anvari et al., 2025) and hinder interpretability and comparison of findings (Owczarek et al., 2025). While existing measures have obtained strong reliability scores, further validation studies with more diverse populations are still required for all scales (Owczarek et al., 2025; Ramsay et al., 2025), as well as wider representation of the various dimensions of climate anxiety (Chan, Tam, et al., 2024). Despite this heterogeneity, a recent study suggested that different climate distress scales may be capturing the same latent construct (see Chapter 4), highlighting the risk of engaging in the "construct redundancy fallacy" (Hodson, 2021, p. 586), whereby differently-named constructs are erroneously believed to correspond to different latent characteristics.

Our goal was to condense the broad spectrum of eco- and climate anxiety measures into a short and unidimensional scale, by retaining the empirically best items from existing scales, thereby advancing a more parsimonious measurement. We used a mixed-method approach across three studies. In Study 1, we surveyed a general population United States (U.S.) sample (*N* = 305) to examine the performance of a pool of 129 items from six measures of climate anxiety neighbouring constructs, using Rasch modelling for item selection. In Study 2, we surveyed psychology experts with a professional interest in climate anxiety (*N* = 31) to determine the relevance and appropriateness of the items selected in Study 1, and we then interviewed some of the participants (*n* = 12) to obtain in-depth feedback about the items and other aspects of the scale. In Study 3, we tested the items retained in Study 2 to re-examine their Rasch model fit, and their convergent, discriminant, and incremental validity, compared to an established measure of eco-anxiety, using a sample of 341 participants from English-speaking countries.

Study 1

Method

Participants and Procedure

Rasch analyses do not have a fixed minimum sample size, depending mostly on how well the data fit the Rasch model assumptions and how evenly participants' responses are distributed across response categories (Edelen & Reeve, 2007). Based on previous Rasch studies (e.g., Medvedev et al., 2018) and on our own resource constraints, we aimed to recruit 300 respondents. To ensure data quality, we employed several non-pre-registered checks to exclude invalid or inattentive responding. The rules and number of exclusions are in Supplementary Table E1. A description of the sociodemographic characteristics of the sample is in Supplementary Table E2. We received ethical approval for this study from the ALPSS Human Research Ethics Committee under delegated authority of University of Waikato (#FS2023-50, accepted October 26th, 2023), and the study was preregistered on OSF (https://doi.org/10.17605/OSF.IO/VYHQG).

We recruited U.S. residents over 18 years old through Amazon MTurk in November of 2023. We presented the study as a questionnaire about emotional responses to a global issue, with the aim of developing a new scale. The MTurk workers were self-selected and received $2 USD for their participation (once their responses were approved). Before accepting the MTurk task, participants had access to a short explanation of the questionnaire, an estimate of the amount of time it would take to complete it (15 to 30 minutes), and the monetary reward they would receive upon completion. Participants then clicked a link to access the Qualtrics questionnaire. Of a total of 305 participants (acceptance rate of 39.35%), 72.13% identified as male, 84.59% as white, and mean age was 33.5 (*SD* = 9.28). Study 1 participants were the same as those in Chapter 4.

Materials

Participants completed a questionnaire containing items from eight climate anxiety measures and neighbouring constructs. These scales were previously identified during a systematic review for a meta-analysis on the association between climate anxiety and wellbeing (see Gago et al., 2024). Specifically, we included 13 items from the Climate Change Anxiety Scale (CCAS; Clayton & Karazsia, 2020), 12 from the Hogg Eco-Anxiety Scale (HEAS-13; Hogg et al., 2021), 10 from the Climate Change Worry Scale (CCWS; Stewart, 2021), 39 from the Eco-Anxiety (EAQ-22), Eco-Guilt Questionnaire (EGuiQ-11), and Ecological Grief Questionnaire (EGriQ-6; Ágoston et al., 2022), 23 from the Climate Change Distress and Impairment Scales (CC-DIS; Hepp et al., 2023), and 32 from the Inventory of Climate Emotions (ICE; Marczak, Wierzba, et al., 2023). To maintain linguistic and presentation consistency across the measures, the wording of the HEAS-13 items was changed to 1st person present tense and to explicitly mention climate change and other global environmental conditions (e.g., Item 1 “Feeling nervous, anxious or on edge.” was changed to “I feel nervous, anxious or on edge about climate change and other global environmental problems.”). We also assessed all the selected items for potential overlaps and removed any that were identical, leading to the exclusion of one HEAS-13 item (Item 8 “Difficulty sleeping”), given its overlap with a CCAS item (Item 2 “Thinking about climate change makes it difficult for me to sleep”). This resulted in a total of 129 items with a uniform response scale for all items: participants were asked to rate the extent to which each item applied to them on a 7-point scale anchored at 0 (*Does not apply to me at all*) and 6 (*Applies to me all the time*). The full item list and labels is in Supplementary List E1. Participants also completed sociodemographic items asking their gender, age, ethnicity, level of education, yearly household income, type of place of residence (rural, town, city), and political orientation (7-point scale from *Strongly conservative* to *Strongly liberal*).

Analysis

Rasch modelling is based on the assumption that the construct of interest is represented by a single unidimensional latent variable, providing information about both the respondents and the measure's items (De Ayala, 2019; Medvedev & Krägeloh, 2022). This characterization of the items is independent of the sample (the measure is invariant across sociodemographic groups), and the person locations are not measure-specific. We used the eRm package (1.0-4; Mair & Hatzinger, 2007; Mair et al., 2009) in Rstudio software (version 4.3.2; R Core Team, 2022) for the Rasch modelling, the psych package (2.3.9; Revelle, 2023) for principal component analyses (PCA) of residuals, and the lavaan package (0.6-16; Rosseel, 2012) for confirmatory factor analysis (CFA).

We analysed the item-level data using Rasch rating scale modelling (RSM) following the steps outlined by Siegert et al. (2010). However, due to the high number of items and the software we used, we had to adapt the order of the steps in our initial analyses. Our process was iterative, meaning that we repeated these steps until we were left with a set of items which fulfilled all of our selection criteria and the overall model had acceptable fit indices (Tennant & Conaghan, 2007). We analysed response category frequency (should have at least one response per category), item characteristic curves (should have correctly ordered thresholds), unstandardized infit and outfit (should be between .60 and 1.40), differential item functioning (DIF; should be non-significant), PCA of residuals (first contrast should have an eigenvalue no higher than 2.0), and the residual correlation matrix (no pairwise correlation should be higher than .2 compared to mean of all residual correlations).

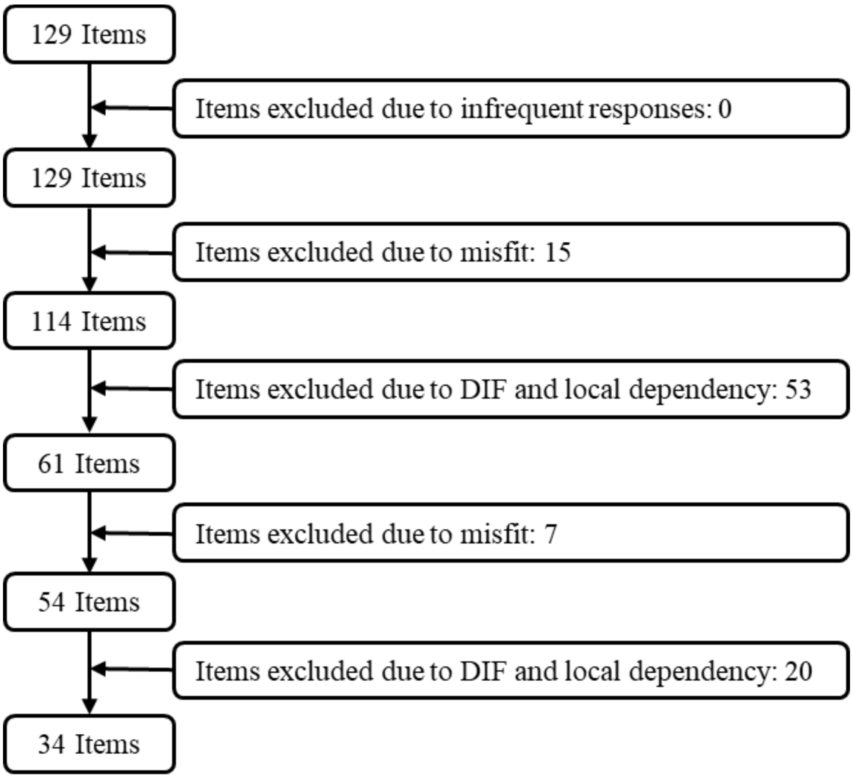
Overall model fit included examining the person location mean (should be within -.50 and .50 logits to item location mean), visualizing the Wright map, calculating the predictive power of the model, examining person separation reliability (PSR) and the item separation reliability (ISR) (should be no lower than .7), and comparing the obtained model to models obtained via item-to-total correlations and EFA. A more thorough explanation of the iterative Rasch analysis process is available in the Supplementary Materials.

Results

Figure 5.1 outlines the item selection process. The 20th iteration of the model satisfied all our criteria for fit to the Rasch model assumptions. For the thresholds to be correctly ordered, we reduced the response options from seven to four categories by combining options 0 (*Does not apply to me at all*) and 1 (*Almost never applies to me*), 2 (*Rarely applies to me*) and 3 (*Applies to me sometimes*), and 5 (*Applies to me very frequently*) and 6 (*Applies to me all the time*) – and kept option 4 (*Often applies to me*) by itself.

Figure 5.1

Item Selection Process for Rasch Analysis in Study 1



The ICC for the retained 34 items is given in Supplementary Figure E1, the summary statistics required to determine model fit in Supplementary Table E3, and the individual statistics for the final set of items in Supplementary Table E4. In brief, the final 34-item model obtained excellent fit and reliability statistics (PSR = .958; ISR = 1.000) and is unidimensional (highest eigenvalue was 1.88). The retained items function similarly across gender, age (only DIF in one response category for five items), and ethnicity (one category with DIF in one item). However, the measure only predicted 1.627% of variability in the data.

The Wright map of persons and items (Supplementary Figure E2) and mean person location show that the items are poorly distributed across the latent trait scale, and the items do not accurately target the level of climate anxiety displayed by participants who scored towards the higher end of the scale. The RSM provided a more parsimonious solution than item-total correlations and EFA approaches, both of which clustered a larger number of items together (129 for the item-total correlations, and 100 for the EFA). We then replicated this Rasch modelling for item selection with a sample of undergraduate students. Surprisingly, a different set of 21 items were obtained, with only seven items present in both studies' final models (see Study 1b in Supplementary Materials).

Discussion

We used Rasch modelling in two separate samples (general population, *N* = 305; undergraduates, *N* = 143) to retain only the best-functioning items out of all 129 from existing scales. Our results show that across the two samples, there was a set of 48 items which fulfilled our criteria in at least one of the samples (34 in the general population, plus the 21 in the undergraduate sample, minus the overlapping seven in both). Rasch measurement models should be invariant across samples (Medvedev & Krägeloh, 2022), but the two sets identified differed significantly, indicating that the items may not function similarly across distinct groups of people. Furthermore, the items behaved differently between younger and older participants (some items were more readily endorsed by older participants, particularly in Study 1b) and were not good at differentiating levels of climate anxiety, needing further examination.

Content-wise, the items address excessive anxiety and distress, the ability to control these feelings, as well as other emotions (i.e., guilt and anger; see Supplementary Tables 4 and 7). However, the items do not cover other often-reported aspects of climate anxiety, such as hopelessness (Gunasiri et al., 2022) or difficulty sleeping (Ogunbode et al., 2023). There is also a lack of items assessing physiological symptoms (e.g., feeling sick, increased heart rate), which are commonly included in domain-free anxiety and depression measures (see Chapter 4); though this absence is due to current measures of climate anxiety not assessing physiological symptoms (see Chan et al., 2024).

The results obtained are nevertheless an encouraging first step in obtaining a consolidated measure of climate change anxiety, as evidenced by the excellent fit of the items to the Rasch model and their excellent reliability of the estimated item parameters (Debelak et al., 2022, p. 86). However, while the items are empirically solid, they need to be corroborated from a theoretical standpoint. In Study 2, we consulted experts to further improve our item pool by seeking feedback about the relevance and format of the items as well as about current shortcomings of the provisional scale as a whole.

Study 2

Method

Participants

We used mixed methods to analyse the relevance of the candidate items and the appropriateness of the overall scale. Study 2 participants were psychology experts with a professional interest in climate change anxiety. A total of 31 experts completed the survey, and 12 of them agreed to a follow-up interview. Most survey participants were clinical psychologists (32.3%) from New Zealand (61.3%), while most interviewees were academics/researchers (58.3%) also based there (41.7%). Supplementary Tables E8 and E9 describe the samples' sociodemographic characteristics. Ethics approval was obtained from ALPSS Human Research Ethics Committee under delegated authority of University of Waikato (#FS2024-25, accepted July 2nd, 2024) and the study was pre-registered in OSF (https://doi.org/10.17605/OSF.IO/JGCBH).

Instruments

The Qualtrics survey included the 48 candidate items retained from Studies 1 and 1b. Participants rated each item's importance for measuring climate anxiety on a 5-point scale (1 = *Not relevant at all*, 5 = *Extremely relevant*)—defined in the survey as the various thoughts, feelings, and behaviours that people can have in response to climate change. Participants could leave comments about each item and overall scale in open-text boxes.

The first half of the semi-structured interview asked experts about their experiences with climate anxiety in their professional practice, and how they understand and define it, which builds on previous research that used similar methods (e.g., Pitt et al., 2024). The second half aimed to expand upon their survey responses by allowing experts to provide their overall opinion on the scale and its items, how it could be improved, and how it could be useful in their work. The full interview script is available in Supplementary Material E1.

Procedure

Data collection took place between July and December 2024. We contacted experts by emailing organizations that focused on the interlink between climate change and mental health (see Supplementary List E2). We also directly emailed experts and clinical psychology university departments across Australia and New Zealand and encouraged further sharing of our call for participation. Participants who completed the survey could volunteer for the follow-up interview by checking a box. Only one interview participant was contacted directly, to include a Māori perspective in this part of the study.

The 30- to 50-minute interviews were done in one session, through Microsoft Teams. They were recorded (audio and video) for transcription, during which any identifying information was masked or deleted (unless otherwise agreed to by the participant). The participants had 3 weeks to review the transcripts to correct any information, after which the recordings were deleted to preserve confidentiality.

Analysis

We calculated each item's mean, median, and Aiken content validity index (Aiken, 1980). Aiken's index corresponds to the percentage of experts who rated the item above the midpoint of the scale (3 = *Somewhat relevant*). We eliminated items with Aiken indices below 70%. We then took into account each item's content, their mean and median relevance scores, and any comments left by respondents to determine which items should be retained or amended. Using the theoretical model of climate anxiety by Crandon, Scott, et al. (2024), we identified underrepresented areas and developed new items to address these shortcomings (some original and some that incorporated content from previously excluded items).

We used reflexive thematic analysis (Braun & Clarke, 2021) to analyse the interview transcripts. Grouping information into themes allowed us to integrate insights from the two interview foci. By adopting a relativistic contextualist approach, we acknowledge that no single objective truth exists, that multiple participants can have contrasting opinions on the same subject, and that these opinions are informed by their background. This includes our own role as researchers in generating themes. A full positionality statement is available in Supplementary Material E2.

The thematic analysis was recursive and descriptive, using NVivo software (version 14.23.4; Lumivero, 2024). After a familiarisation process, the first author performed two rounds of coding until the information was satisfactorily categorized into meaningful codes. The coding was initially more semantic and deductive, but as we became more familiar with the data and the theoretical frameworks used, we adopted a more balanced coding approach that was more latent and inductive. Codes were clustered according to content similarity and organized into themes with a central organizing idea. The main aim was to construct themes that would aid scale development by understanding how it can be used and improved.

Results

The six themes generated from the interviews, listed in Table 5.1, helped with understanding the purpose and shortcomings of the scale, rather than solely for selecting or adjusting individual items. Quotes from the participants are in Supplementary Table E10.

Table 5.1

Themes Generated from Reflexive Thematic Analysis in Study 2

Theme Name	Number of Codes	Frequency of Codes	Percentage of Coverage
The Wider Context	14	180	24.64%
Climate Anxiety is Heterogenous	12	143	20.60%
The Spectrum of Climate Anxiety	8	139	17.58%
Climate Anxiety can be in the Background	9	120	15.42%
Streamlining Measurement	7	63	9.09%
Climate Anxiety is a Social Justice Issue	3	22	3.17%

Theme 1: The Wider Context

The most frequently discussed theme concerned how climate anxiety can be different across countries and cultures, as well as the challenges and processes required to ensure a scale can reflect these differences. In this respect, points raised by the experts align with calls to use a combined etic-emic approach when developing cross-culturally sound psychological measures (Y. H. Poortinga, 1997, pp. 352-353). Experts also highlighted the need for special considerations when assessing climate anxiety among those directly exposed to climate change's impacts, due to the traumatic effect these events can have, compared to those who experience them vicariously, which aligns with previous research (Garfin & Wong-Parodi, 2024; Reser et al., 2014). This is especially relevant in the Global South, where climate anxiety is not often discussed (dos Santos et al., 2024), and where practical matters usually take precedence (see Butler, 2025).

Our main takeaway from this theme is that our scale's scope is limited to the individual factors outlined in the Crandon, Scott, et al. (2024) model, and does not take into account important systemic and contextual factors (see Crandon et al., 2022; Tam & Milfont, 2020). It has been developed through a Western lens and based on similarly Western scales that do not directly consider culture-specific impacts and ontologies

(Aruta & Guinto, 2022; Tupou et al., 2023). We believe that while the score provided by the scale can be an important metric for guiding the therapeutic process or between-individual comparisons, it should be complemented with contextual information that the scale cannot capture by itself.

Importantly, interviewees recognized that the scale has potential to be adapted to other contexts by following certain methodological procedures and including researchers from other cultures, a point that has been argued for climate-change-related research in Pacific communities by Newport et al. (2023). This also aligns with the efforts highlighted by Boehme et al. (2024) regarding the need to further validate scales in non-Western cultures.

Theme 2: Climate Anxiety is Heterogenous

A separate theme concerned the various forms that climate anxiety can manifest even between people of the same culture. The heterogeneity of presentations was one of the most mentioned aspects by participants when describing research participants or clients who were struggling with climate anxiety, which is congruent with previous research (Coffey et al., 2021; Pihkala, 2020a; Soutar & Wand, 2022). Experts reported seeing not just worry and anxiety, but a variety of climate-related emotions, including sadness, anger, guilt, and deeper feelings of existential despair and hopelessness (e.g., Pihkala, 2022c). This existential aspect is one of the more differentiating characteristics of climate anxiety compared to domain-free anxiety or depressive disorders. Threat-related emotions (i.e., worry, anxiety) were more explicitly seen as part of the core climate anxiety experience. Other emotions, like anger and guilt, were not as easily linked to climate anxiety by the people experiencing them, but some experts recognized them as important eco-emotions that should also be explored due to how they interact with the feelings of anxiety (see Crandon, Scott, et al., 2024). Thus, experts opted to cast a wide "emotional net", when exploring the various climate emotions a person is experiencing. People can cycle through various emotions, even including positive emotions related to social connection and hope, as has been mentioned in some climate anxiety models (e.g., Pihkala, 2022b).

Experts also shared that behaviourally, climate anxiety can motivate both individual and collective mitigation action, greater engagement and connection with nature, as well as lead to feeling too paralysed to do anything, which is consistent with the literature on pro-environmental behaviour (e.g., Chapman & Peters, 2024; Schwartz et al., 2023). Cognitively, people struggle with uncertainty and feeling overwhelmed (see Climate Psychology Alliance, 2022; Pihkala, 2020a), worrying about what the future will look like and the impact climate change will have on the next generations of loved ones (e.g., Soutar & Wand, 2022).

From this theme, we conclude that a consolidated climate anxiety scale should be holistic enough to cover the variety of climate anxiety presentations, which would mean including a large number of items, but it should still be short and simple enough to be used in research and applied settings. Many experts, particularly those in the clinical field, emphasized the importance of the practicality of using the scale in their professional practice.

Theme 3: The Spectrum of Climate Anxiety Outcomes

Another theme related to the variety of presentations of climate anxiety concerns the level of functional impairment associated with it. These impairments were mentioned in almost all the interviews and were highlighted as one of the most important aspects of working within this topic (see Clayton & Karazsia, 2020). Functional impairments are associated with lower wellbeing and are a common diagnostic criteria for psychopathology in the DSM-5 (American Psychiatric Association, 2013). Despite sharing this crucial characteristic with some psychological disorders (see Cosh, Ryan, et al., 2024), climate anxiety is still seen not as a manifestation of a broader anxiety or depression disorder, but rather as something that can occur comorbidly with them. Whether climate anxiety should be considered a psychological disorder itself was noted by interviewees, with experts recognizing the complexity of this discussion and most noting climate anxiety as a valid rational reaction to dire environmental circumstances, as has been noted in other studies (Clayton, 2020; Pitt et al., 2024). One participant was more sceptical, arguing that stronger reasons are needed to justify not classifying climate anxiety as a disorder, given the functional impairments associated with it and the high overlap it has with other psychopathologies.

Regardless of how it is categorized, experts see the outcomes of climate anxiety as occurring on a spectrum (see Crandon, Scott, et al., 2024; Doherty & Clayton, 2011). While the impairments for some people are negative, and sometimes tragic, potential positive outcomes were also mentioned. These included experiencing positive emotions like feeling motivated and hopeful (e.g., Pihkala, 2022c), and behaving pro-environmentally (e.g., Ballew et al., 2023). Again, participants expressed the idea of oscillations between adaptive and maladaptive outcomes (see Pihkala, 2022b).

This theme has implications for the interpretability and temporal reliability of the scale score in the clinical context. Higher scale scores should not be indicative of a diagnosis, given that climate anxiety is not considered a disorder. However, it signals the need for psychological help due to the level of impairment observed (Cosh, Williams, et al., 2024). As such, the individual items may be more informative in a clinical context by signalling which areas should be prioritized for intervention, allowing for a more personalized approach, whereas full scale scores may be more relevant for between-participant research. Usability in therapeutic monitoring and/or within-participant research will depend on the test-retest reliability of the scale. Lastly, the items only assess the maladaptive end of the climate anxiety spectrum, and another instrument will be more suitable to measure potential adaptive outcomes of climate anxiety (Crandon, Scott, et al., 2024).

Theme 4: Climate Anxiety can be in the Background

This theme concerned how people are often unaware of their own climate distress. This was particularly evident for the interviewed experts working in the clinical field, who often mentioned that climate anxiety was more of a background concern for their clients. With the exception of those directly exposed to climate change's more observable and felt impacts, climate anxiety tended to emerge throughout the therapeutic process as one of many concerns and rarely the most prominent one, which aligns with previous findings (Soutar & Wand, 2022; van der Linden, 2017). Some explanations put forth for this reduced salience of climate anxiety in clinical settings included the role of social disavowal and self-protection as ways of denying or minimizing threatening feelings (see Norgaard & College, 2006), general ignorance of the connection between climate change and internal experiences, and a lack of enquiring about these feelings. The experts considered the items in our scale useful for bringing these experiences to conscious awareness, particularly the more mildly-worded ones (whereas for people who were already aware of their climate distress, these mild items were deemed unnecessary and trivial).

Our takeaway from this theme is that our scale can help an initial assessment phase, or help therapists identify potential emerging concerns about climate change to guide case conceptualization, as has been argued by Cosh, Ryan, et al. (2024) and Pitt et al. (2024). In a research context, the scale might also be useful to clearly delineate what climate anxiety is, and if there are certain types of symptom presentations or clusters that occur more frequently.

Theme 5: Streamlining Measurement

This theme focused on how experts appraised the current state of climate anxiety measurement and the considerations they had when employing these scales in their professional practice. Participants emphasized the psychometric properties of questionnaires as the key factors determining the usefulness of a scale, and that there is still some room for improvement regarding the validity of existing climate anxiety scales (e.g., Ramsay et al., 2025).

Ultimately, experts invoked the importance of converging conceptualizations, theories, and assessment (see van Valkengoed et al., 2023). Creating a new scale when others already exist can undermine this convergence, so its development must be well justified. Scholars disagree about whether developing more measures is beneficial to the development of knowledge (cf. Anvari et al., 2025; Iliescu et al., 2024), and this issue was also raised by our interviewees. Participants mentioned the importance of having a solid theoretical basis for the scale, as it can help guide and inform assessment and intervention in psychotherapy.

We conclude that our scale should be one that streamlines measurement, making it comparable across contexts by having solid conceptual underpinnings. However, we must acknowledge the inherent limitations of quantitative scales, which can never be as in-depth and tailored as other methods. Notwithstanding, they can be used complementarily, both for informing case formulation and intervention, and conducting wider-scale research.

Theme 6: Climate Anxiety is a Social Justice Issue

Finally, a few of the experts discussed how people also connect climate change concerns to other current global and societal issues (e.g., Hogg et al., 2021; Soutar & Wand, 2022), such as more general environmental degradation or the rise of fascism. These connections have been explained within the framework of the Environmental Justice Paradigm (Taylor, 2000), an eco-centric framework that includes a variety of environmental, labour, and social guiding principles. Accordingly, there are important links between climate change and other social justice issues, such as human rights (e.g., Athy et al., 2022). We conclude that the climate crisis is seen as one of many issues that affects the world, and psychologists should avoid over-individualizing people's emotional reactions to it (Budziszewska & Jonsson, 2021; Ojala et al., 2021).

Regarding the quantitative analysis and item selection, the descriptive statistics of all 48 items included in the survey to experts are available in Supplementary Table E11. Sixteen items had an Aiken index lower than 70% and were excluded. We compared the scores and comments of items that covered similar content, resulting in the exclusion of an additional 13 items. The 23 remaining items were retained for amendment according to the comments of the experts. Having analysed the climate anxiety model's subdimensions represented in these items, we developed three additional items to cover existential conflict aspects of climate anxiety that were underrepresented.

We combined item pairs that were similar in content (e.g., Items 4 and 29), split items to more adequately represent different subdimensions (Item 31 was separated into three new items), and reworded items to better represent the subdimensions or improve their readability. We changed all items to active voice and the sentence structure of some to keep it uniform across the entire scale. A full list of the items, the amendments, and the justification for the changes is available in the OSF project page for this study. After this stage, we retained 22 candidate items for validation in Study 3.

Discussion

In summary, our goal was to consolidate the best climate anxiety items from existing measures into a new scale that covers the heterogeneity of climate anxiety, guided by a recently proposed theoretical model (Crandon, Scott, et al., 2024). This new scale could be helpful for academic research and case formulation for clinicians (both in cases of explicit as well as potentially latent distress). Although the scale can be adapted to other populations, it is limited by its inability to capture macrosystem factors and by the cultural background in which it was developed. Study 2 allowed us to obtain a final provisional scale that is both theoretically and empirically solid. Whether this scale is useful will depend on further validation efforts, which we start to address in Study 3 by examining the fit, reliability, and validity of the 22-item scale.

Study 3

Method

Participants

Study 3 participants were native English speakers over the age of 18, recruited through Amazon MTurk. We presented the questionnaire in the same manner as Study 1. The workers were self-selected, and received $1.15 USD for their participation, after approval. This study received ethical approval from the ALPSS Human Research Ethics Committee under delegated authority of University of Waikato (#FS2024-71, accepted December 16th, 2024), and was pre-registered in OSF (https://doi.org/10.17605/OSF.IO/GWA8M).

We received a total of 2682 responses on Qualtrics (acceptance rate of 12.7%, most exclusions were due to bot responses, see Supplementary Table E1 for all exclusions). Our final sample had 341 participants, 97.6% from the United States and 88.6% identifying as white. The mean age of participants was 36.8 (SD = 12.0) and 51.2% identified as male. A full description of the sample's sociodemographic characteristics is in Supplementary Table E12.

Instruments

The Waikato Climate Anxiety Rasch Scale (WCARS) comprised the 22 items retained from Study 2. Unfortunately, an oversight led to one of the items being excluded ("I worry about the impacts of climate change for future generations") and one amended item was mistakenly included in its original version ("I'm scared that climate change is destroying nature"). The response scale was changed to a 5-point scale (0 = *Does not apply to me at all*, 4 = *Applies to me all the time*), given the need to collapse response categories in Study 1. We used the HEAS-13 (Hogg et al., 2021) to test our measure's convergent validity. This multidimensional scale measures four eco-anxiety dimensions (Affective Symptoms, Rumination, Behavioural Symptoms, and Anxiety about Personal Impact) over the past 2 weeks using a Likert-type scale ranging from 0 (*Not at all*) to 3 (*Nearly every day*), with higher scores indicating higher anxiety about the global environmental crisis. We expected WCARS and HEAS-13 scores to be positively correlated.

To test divergent validity, we selected three self-report measures. The 21-item Depression, Anxiety, and Stress Scale (DASS-21; Lovibond & Lovibond, 1995) was used as a measure of domain-free psychological illbeing symptoms. Each item was rated on a Likert-type scale anchored at 0 (*Did not apply to me at all*) and 3 (*Applied to me very much, or most of the time*). The DASS-21 includes three subscales (depression, anxiety, and stress), as well as a full-scale score as a measure of domain-free general distress over the past week. We expected the WCARS to be positively correlated with DASS-21 scores. To measure domain-free wellbeing we used the five items of the World Health Organization Wellbeing Index (WHO-5; World Health Organization, 2024), answered on a scale from 0 (*At no time*) to 5 (*All of the time*), with higher scores indicated higher psychological wellbeing. We expected WCARS scores to be negatively associated with WHO-5 scores. We used the 15-item New Ecological Paradigm Revised Scale (NEP-R; Dunlap et al., 2000) to measure pro-environmental attitudes, answered in a Likert scale ranging from 0 (*Strongly disagree*) to 4 (*Strongly agree*), with higher scores reflecting a greater pro-environmental orientation, which we expected to be positively correlated with WCARS scores. We expected these discriminant correlations to be weaker than the association between the WCARS and HEAS-13 (see Clark & Watson, 2019). Lastly, we used the four-item Six Americas Short Survey (SASSY; Chryst et al., 2018) to characterize participants' beliefs in climate change according to one of six groups: alarmed, concerned, cautious, disengaged, doubtful, and dismissive.

Procedure and Analysis

Data collection took place between December 2024 and January 2025. The data collection procedure through MTurk was the same as Study 1. The measures were presented in a random order (as were the items within each measure), with the sociodemographic questions always presented last. A code was given for participants who were not flagged as bots or duplicate responders, allowing us to match the Qualtrics responses to the MTurk workers. These were used to ensure data quality, together with four attention check questions, one in each questionnaire (with the exception of the WHO-5 and SASSY).

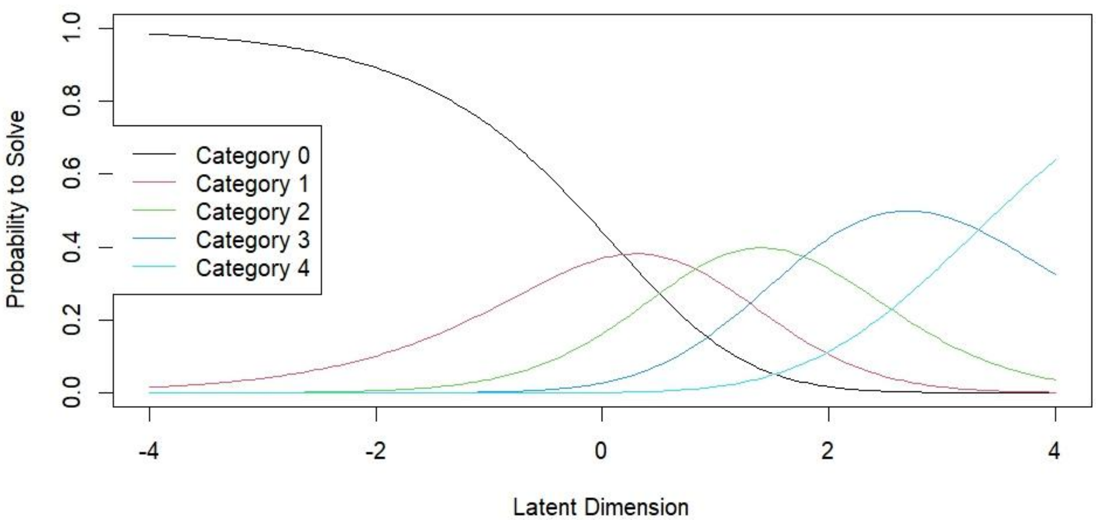
Our correlational and latent analyses were conducted in Jamovi (2.3; The Jamovi project, 2021) and the Rasch modelling in Rstudio (4.4.1; R Core Team, 2022) using the same packages as Study 1, plus the SEMLj package (Galluci & Jentschke, 2021). The procedure for the Rasch RSM was equal to Study 1, with the exception that we did not conduct DIF analysis for ethnicity due to the unbalanced composition of the sample. We assessed each scale’s structure using CFA (see Supplementary Table E13) and saved the latent factor scores to use in structural equation modelling (SEM). We used correlation coefficients to assess convergent and discriminant validity and Soper's (2025) significance of difference of correlations to examine whether convergent validity correlations were stronger than discriminant validity correlations. For incremental validity, we used a latent path model in SEM predicting WHO-5 and DASS-21 scores from our preliminary scale and HEAS-13 scores, using robust estimators to account for non-normality (or mean adjusted scale tests when robust tests were not available). We also used an item parcelling strategy to reduce the number of parameters calculated (Landis et al., 2000; see Milfont & Duckitt, 2004, for a practical aplication).

Results

The first iteration of the 21-item WCARS model satisfied our fit and threshold ordering criteria. For illustration, the ICC for one of the items is available in Figure 5.2, and Tables 5.2 and 5.3 present the summary fit statistics for the overall model and the individual items. The 21-item WCARS model obtained excellent fit and reliability statistics (PSR = .955; ISR = 1.000) and predicted 47.47% of variability in the data. Four items exhibited significant age DIF for over half the response categories (some items were more readily endorsed by younger respondents, and other by older respondents), and an additional item exhibited significant gender DIF (more readily endorsed by female respondents). The scale was not unidimensional, with a total of 12 items sharing correlations that were not accounted by the latent climate anxiety trait. No items were deleted from the scale at this point due to their contribution towards content representation (see Hughes et al., 2022).

Figure 5.2

Item Characteristic Curve for Item 21 of the WCARS in Study 3



Note. ICCs were shaped the same for all items, differing only in their location in the latent dimension. Item 2 wording: “I feel terrified by the effects of climate change”.

Table 5.2

Summary Statistics for the Final WCARS Model in Study 3

	Items	Persons
Logit Scale Mean Location (SD)	.000 (.495)	.814 (1.584)
Standard Error Mean (SD)	.069 (.002)	.308 (.134)
Infit Residuals Mean (SD)	.970 (.148)	.966 (.457)
Outfit Residuals Mean (SD)	.947 (.160)	.947 (.451)
Separation Reliability	1.000	.955

Table 5.3

Location and Fit Statistics for Items Included in the Final WCARS Model in Study 3

Item	Originally from	Mean Rating [a]	Location	SE	Infit MSE	Outfit MSE
1. I feel uneasy when I think about climate change and other global environmental problems.	HEAS-13 + EAQ-22	1.809	-.347	.068	.773	.842
2. I feel terrified by the effects of climate change.	EAQ-22 + CC-DIS	1.667	-.114	.068	.853	.796
3. I can't stop seeking out information about climate change in the media (e.g., TV, newspapers, internet).	CCWS	1.507	.145	.068	1.178	1.159
4. I worry about how climate change may affect me and the people I care about.	CCWS	2.021	-.694	.069	1.108	1.093
5. I feel uncomfortable or guilty that I am part of a system that may be amplifying climate change.	EGuiQ-11	1.669	-.118	.067	.997	.946
6. I worry that climate change is destroying nature.	EgriQ-6	2.121	-.869	.070	1.118	1.118

Item	Originally from	Mean Rating [a]	Location	SE	Infit MSE	Outfit MSE
7. I am unable to stop thinking about climate change.	HEAS-13	1.462	.224	.068	.844	.796
8. I have problems with my family, studies, or work because of my climate change concerns.	CCAS	1.111	.818	.072	1.148	1.231
9. I feel angry when I see how little corporations and governments do to stop climate change.	CC-DIS + ICE-Ang	1.915	-.520	.068	1.272	1.180
10. I feel distressed when I see news about climate change.	CC-DIS	1.844	-.413	.068	.891	.970
11. I experience physical symptoms (e.g., headaches, nausea, shortness of breath, heart palpitations) when thinking about climate change.	Original (closest item in CC-DIS)	1.053	.926	.073	1.060	.879
12. I feel fatigued or have difficulty concentrating because of climate change.	Amended (close items in CC-DIS and CCAS)	1.182	.696	.071	.967	.867
13. I feel restless or have difficulty sleeping because of climate change.	Amended (close items in CC-DIS, CCAS, HEAS-13)	1.226	.618	.070	.841	.715
14. I feel overwhelmed by the consequences of climate change.	ICE-Anx	1.619	-.039	.068	.769	.766
15. I feel like everything seems uncertain because of climate change.	ICE-Anx	1.738	-.237	.068	.802	.861
16. I feel hopeless about our ability to fight climate change.	ICE-Ent	1.711	-.196	.068	1.100	1.119

Item	Originally from	Mean Rating [a]	Location	SE	Infit MSE	Outfit MSE
17. I feel powerless or paralyzed when I think of how difficult it is to live in a climate-friendly way.	ICE-Pow + CCWS	1.447	.252	.068	1.014	.996
18. I feel lonely because it's difficult to talk about my climate change concerns with other people.	ICE-Iso	1.344	.407	.069	.943	.865
19. I feel sad because the world I know is disappearing forever due to climate change.	ICE-Sor	1.788	-.316	.068	.805	.804
20. I think about the end of humankind because of climate change.	Original	1.847	-.404	.068	1.029	1.110
21. I feel like everything is pointless because of climate change.	Original	1.487	.179	.068	.854	.769

[a] On a scale of 0 (*Does not apply to me at all*) to 4 (*Applies to me all the time*).

An EFA suggested the existence of two correlated factors (eigenvalues of 13.55 and 1.17 respectively, supported by parallel analysis). The first factor explained 40.1% of variance, and the second factor explained 30.8%. Item-to-total correlations showed every item was strongly correlated to the total score (ranging from .724 to .841). The Wright map (Figure 5.3) shows items were again skewed towards the positive side of the scale, but they were distributed across different points of the scale on this side. Together with the mean person location value, the Wright map shows that the items were not accurately targeting participants' levels of climate anxiety.

Figure 5.3

Wright Map for the 21-Item WCARS in Study 3

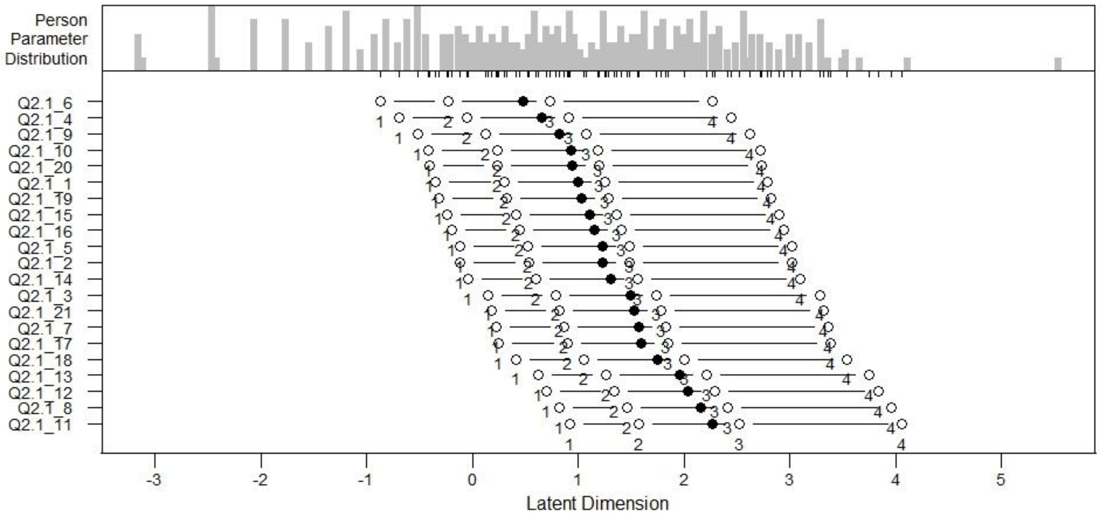


Table 5.4 shows the correlations between our climate anxiety scale and the other measures. As predicted, WCARS scores were strongly positively associated with HEAS-13 scores and DASS-21 scores. Also as anticipated, given their construct overlap, WCARS correlated more strongly with the anxiety subscale of the DASS-21 than with depression or stress; see Supplementary Table E14 (which also includes correlations with the HEAS-13 subscales). However, the positive correlation with WHO-5 scores and the non-significant correlation with NEP-R scores go against our predictions. Nonetheless, the WCARS and HEAS-13 both exhibited similar correlation patterns with the other measures (though the HEAS-13 had a significantly stronger association with the DASS-21; z = -2.73; p = .006), supporting the criterion validity of the WCARS. As expected, the correlation between the WCARS and the HEAS-13 was significantly stronger than the one between the WCARS and

the DASS-21 scores (z = 3.68; p < .001). WCARS scores were also negatively associated with a conservative political orientation[2].

Table 5.4

Descriptive Statistics, Normality, and Correlations of Observed Scale Scores in Study 3

Scale	*M (SD)*	Shapiro-Wilk	ω	1	2	3	4	5	6
1. WCARS	1.60 (1.09)	.94***	.97	-	.85***	.75***	.11*	.06	-.19***
2. HEAS-13	.95 (.85)	.89***	.97	.85***	-	.83***	.07	-.11*	-.09
3. DASS-21	1.01 (.84)	.91***	.97	.75***	.80***	-	-.19***	-.10	-.12*
4. WHO-5	3.28 (1.22)	.91***	.92	.11*	.07	-.19***	-	-.26***	.21***
5. NEP-R	2.39 (.66)	.95***	.84	.02	-.15**	-.17**	-.19***	-	-.31***
6. Conservative Political Orientation	4.21(2.24)	.87***	-	-.19***	-.10	-.11*	.20***	-.29***	-

Note. ω = McDonald's omega. Spearman correlations are presented below the diagonal, and Pearson correlations above the diagonal.

* p < .05. ** p < .01. *** p < .001.

Complementing the correlation analysis, we computed latent path models. Our baseline model considering only the HEAS-13 (determined by its four dimensions) as the predictor had good fit: $\chi^2(58)$ = 123.2; CFI = .971; TLI = .967; SRMR = .057; RMSEA = .061; 90% CI [.046, .075]. In this model, the HEAS-13 significantly predicted DASS-21 (β = .80, p < .001) and explained 63.9% of its variance. To test the incremental validity of the WCARS,

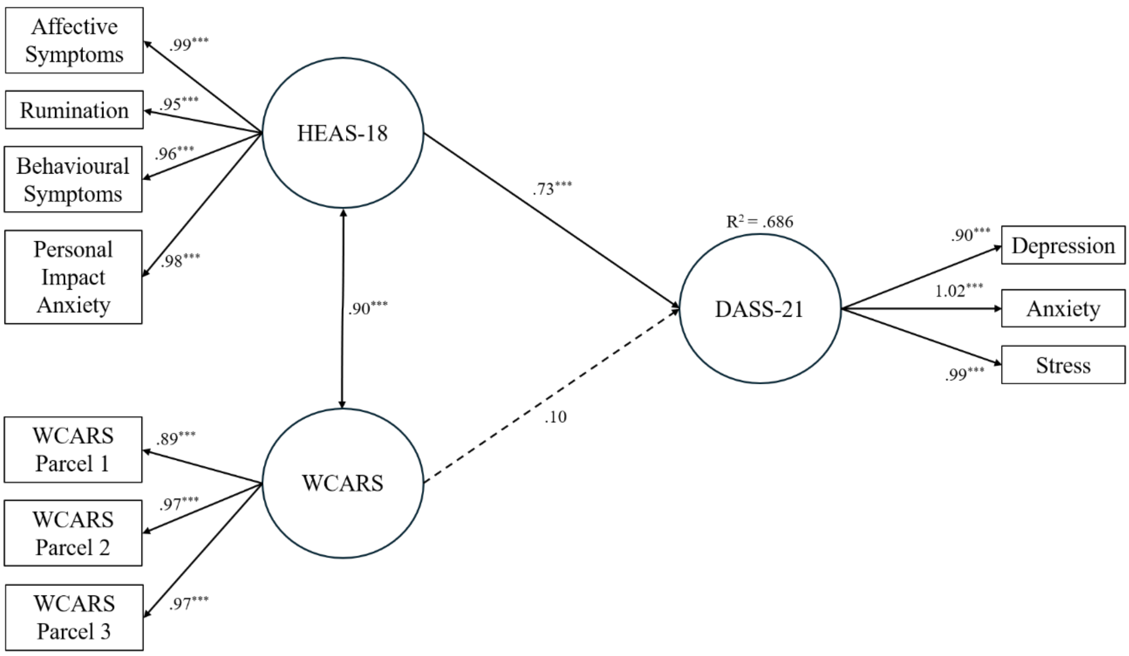
[2] We initially pre-registered an ANOVA to test for differences in climate anxiety scores between political groups but opted to report correlations instead. The results of the Kruskal-Wallis test showed that the liberal group had significantly higher scores than the centre and conservative groups, which did not differ from each other. The results of this analysis (and Kruskal-Wallis tests for the SASSY groups) are available in the Supplementary Materials.

we tested a model with the full WCARS and the HEAS-13 as predictors of the main outcomes considered (the DASS-21, determined by its three dimensions, and the WHO-5). This model did not achieve convergence, indicating an improper solution (Brown, 2006). To simplify the model, we tested various alternatives (see Supplementary Tables E15 and E16 for the models and corresponding fit statistics). Here, we report two of these models.

First, given the relatively weaker association between the WHO-5 and our two climate anxiety measures, we removed this outcome from the model and predicted just the DASS-21 scores from the WCARS and the HEAS-13 (Figure 5.4). This model had good fit to the data: χ^2 (32) = 175.1; robust CFI = .999; robust TLI = .998; robust SRMR = .028; robust RMSEA = .039; 90% CI [.033, .045]. The HEAS-13 significantly predicted DASS-21 (β = .73, $p < .001$), whereas the WCARS did not (β = .10, p = .409). This model explained 68.6% of variance of DASS-21 scores.

Figure 5.4

Full Latent Path Model with the HEAS-13 and WCARS Predicting DASS-21 in Study 3



Note. HEAS-13 = Hogg Eco-Anxiety Scale; WCARS = Waikato Climate Anxiety Rasch Scale; DASS-21 = Depression, Anxiety, and Stress Scale; WHO-5 = WHO Wellbeing Index. Paths are standardized estimates.

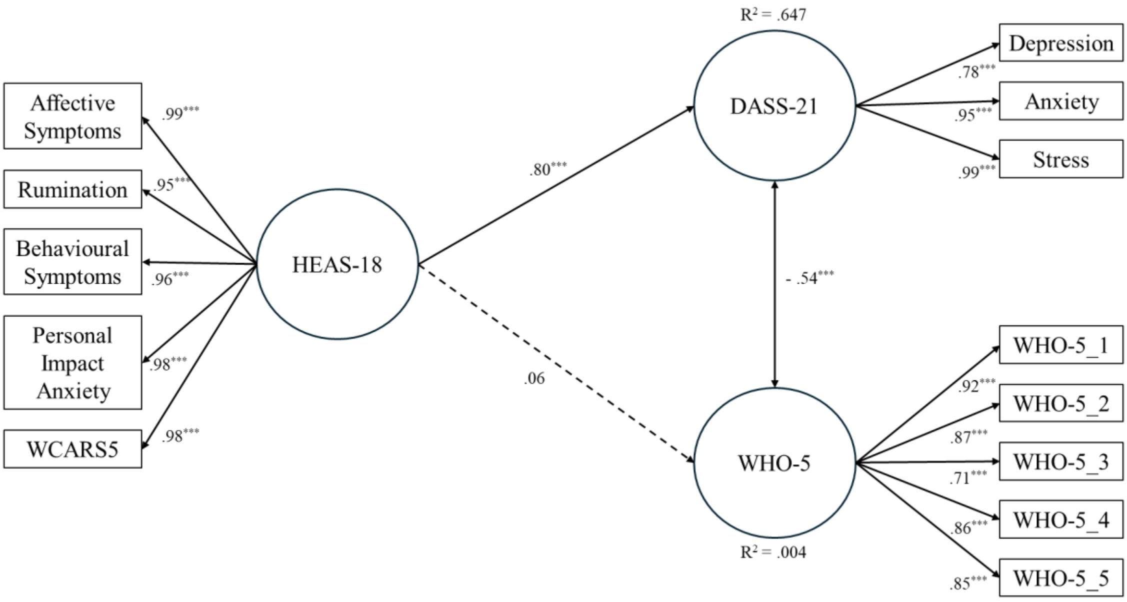
* $p < .05$. ** $p < .01$. *** $p < .001$.

Second, in an attempt to still predict both outcome measures, and given the strong association between the WCARS and HEAS-13 scores, we identified the WCARS items which correlated more strongly to the DASS-21 and did not overlap conceptually with the HEAS-13 items. Our reasoning was to examine whether these items which the HEAS-13 did not cover could add to its predictive power, as an extension of the original scale with a wider content representation. This process led to the identification of five WCARS items (Items 11, 12, 14, 18, and 21). A CFA of the four HEAS-13 factors and this additional five-item factor (hereby called HEAS-18) showed they clustered together: χ^2 (125) = 197.8; CFI = .971; TLI = .964; SRMR = .017; RMSEA = .076; 90% CI [.060, .091].

Using the five-factor HEAS-18 as a predictor, the latent path model depicted in Figure 5.5 had a good fit to the data: χ^2 (70) = 141; CFI = .966; TLI = .963; SRMR = .057; RMSEA = .058; 90% CI [.044, .072]. This expanded climate anxiety measure significantly predicted DASS-21 (β = .80, *p* < .001), explaining 64.7% of variance, but not WHO-5 (β = .06, *p* = .27). These models were statistically comparable, $\Delta\chi^2(12) = 17.8$, *p* > .05, indicating that the more parsimonious HEAS-13 is preferable; however, we discuss the potential usefulness of including the extra five WCARS items.

Figure 5.5

Full Latent Path Model with the HEAS-18 Predicting DASS-21 and WHO-5 in Study 3



Note. HEAS-18 = HEAS-13 plus five WCARS items 11, 12, 14, 18, and 21; DASS-21 = Depression, Anxiety, and Stress Scale; WHO-5 = WHO Wellbeing Index. Paths are standardized estimates.

* *p* < .05. ** *p* < .01. ****p* < .001.

Discussion

In Study 3 we aimed to assess the Rasch model fit of the 21 items comprising the draft version of the WCARS and conduct an initial psychometric assessment of this scale. We found this set of items to have excellent fit and reliability, and it predicted a substantial amount of variability in the data. On the other hand, like in Study 1, the items are only able to differentiate between moderate-to-high levels of climate anxiety. Thus, the WCARS seems more suitable for differentiating between people who are experiencing higher levels of climate anxiety, such as those seeking therapeutic help (Lutz et al., 2023).

The WCARS exhibited similar correlation patterns with our criterion variables as the HEAS-13, lending support to its convergent and discriminant validity. The two climate anxiety scales were strongly correlated with each other, as well as with illbeing. The convergent correlation was significantly stronger than the divergent correlations, supporting the validity of our scale (L. A. Clark & Watson, 2019), though this difference was not substantial. The WCARS was also negatively associated with a conservative political orientation, which has been shown to also occur for the CCAS and CCWS (Leite et al., 2023; Plohl et al., 2023; Stewart, 2021; Wullenkord et al., 2021). That said, two of our predictions were not supported: the WCARS was positively associated with wellbeing despite having a strong positive association with illbeing, and it had a non-significant association with pro-environmental attitudes while the HEAS-13 was negatively associated with the NEP-R. We speculate on what may explain these results in the next section.

While the WCARS and HEAS-13 were both strongly associated with the DASS-21, the WCARS did not predict DASS-21 scores over and above the HEAS-13. Another issue with the WCARS was that it didn’t have a good fit with a unidimensional model, as would be expected from the Rasch analysis. This led to the inability to produce a suitable model that included the full WCARS latent score. We attempted to salvage some theoretically relevant items from the scale as an addition to the HEAS-13. While the combined model adding five WCARS items to the HEAS-13 achieved satisfactory fit, it did not significantly improve the HEAS-13 predictive power. Therefore, our findings are insufficient to justify the WCARS as a new measure of climate anxiety (Anvari et al., 2025).

General Discussion

With this set of studies, we aimed to condense and solidify existing scales of climate anxiety and neighbouring constructs into a short holistic measure that included the conceptually stronger and best-functioning items currently available. We used a mixed-method data-driven approach guided by a theoretical model of climate anxiety (Crandon, Scott, et al., 2024) to develop a scale that combined empirical fit with comprehensive content representation of the various key features of climate anxiety. In Study 1, we identified a subset of 48 items (from a pool of 129 items from existing measures) that fulfilled Rasch model assumptions. We then consulted experts in the field of climate anxiety in Study 2 to remove less relevant items and to obtain input on how our climate anxiety scale should be conceptualized and used in their professional practice. In Study 3, we examined the structure and psychometric properties of the resulting 21 items that formed the WCARS. We found that while the WCARS exhibited similar correlations to other criterion variables as an established measure of eco-anxiety, it did not outperform the HEAS-13 when predicting mental health outcomes.

The WCARS items were good at differentiating between people experiencing more intense climate anxiety, but not for those at low levels. Recent studies using Rasch methodology have reported similar skewed distributions of items for the CCAS (Hannachi et al., 2024) and for the HEAS-13 (Spano et al., 2025). Only the CCWS, in its original development study (Stewart, 2021), obtained a well-balanced distribution of items between low- and high-scoring sides of the latent trait scale. For comparison, Rasch analyses of other domain-specific (e.g., Pallant & Tennant, 2007) and domain-free (e.g., Shea et al., 2009) measures of anxiety and depression also obtained well-balanced distributions of items. This suggests that the item distribution we obtained in Studies 1 and 3 is due to the climate anxiety items and not a characteristic of all symptom-related questionnaire items. Similar to other related measures (see Hannachi et al., 2024; Spano et al., 2025), our measure seems vulnerable to floor effects, and is not sensitive to mild manifestations of climate anxiety. One potential solution, proposed by Lutz et al. (2023), would be to include items from measures of environmental concern, a construct that is considered less impairing than a more personal worry and that can be expressed with less emotional content (van der Linden, 2017). Some experts in Study 2, particularly in health settings, emphasized the importance of items tapping into higher levels of distress, compared to mild-distress items. The WCARS items could thus be helpful in differentiating between these high levels of climate anxiety in health contexts.

The WCARS and the HEAS-13 scores did not correlate as predicted with wellbeing and pro-environmental attitudes. Although contrary to our prediction, it is worth noting that climate-related anxiety has shown mixed associations with both wellbeing (e.g., Gago et al., 2024; Lutz, 2023; Ogunbode et al., 2022) and environmental orientations (e.g., Feather & Williams, 2022b; Lau et al., 2025; Marczak, 2024; Rocchi et al., 2023; Whitmarsh et al., 2022). In both cases, authors have suggested that other variables may moderate associations with climate anxiety. Mental wellbeing may be improved by acknowledging the challenging nature of climate emotions and through social connections that are formed to alleviate this burden (Marczak, 2024). Other suggested protective factors include action-oriented anger (Stanley, Hogg, et al., 2021) or meaning-focused coping strategies (Ojala, 2005), two aspects that were also mentioned by experts in Study 2 as helpful coping strategies they had observed. These person-level variables could limit the impact of climate anxiety on wellbeing to a greater extent than on illbeing. For pro-environmental orientations, Whitmarsh et al. (2022) hypothesized the negative effect of pro-environmentalism on climate anxiety could be due to a buffer effect of engagement in pro-environmental behaviour, which reduces climate anxiety for people with stronger environmental values. Altogether, these findings could signal that feeling distress over climate change can be independent of whether a person has pro-environmental attitudes or believes that humans should be dominant over nature, and that this distress will not necessarily impact a person's ability to flourish (see Doherty, 2018).

One possible reason the WCARS failed to predict wellbeing outcomes could be because of how we conceptualized climate anxiety. We viewed climate anxiety as encompassing a variety of eco-emotions, including worry, sadness, guilt, anger, and hopelessness, which have been argued to be common emotional reactions to climate change (Pihkala, 2022c), as well as closely linked with and even manifestations of climate anxiety (Pihkala, 2020a, 2022b), reflected in strong associations between them (Ágoston, Urbán, et al., 2022; Stanley, Hogg, et al., 2021; Voşki et al., 2023; Zeier & Wessa, 2024). Crandon, Scott, et al.'s (2024) model includes these various emotional reactions as part of the affective response of climate anxiety, and Ramsay et al. (2025) suggested broadening the scope of future reviews to include other eco-emotions like grief and guilt. Moreover, Owczarek et al. (2025) argued that measures of climate anxiety and related constructs should be flexible enough to capture these various emotions, as did the experts who participated in Study 2. However, while there may be conceptual and empirical links between these emotions, it has also been reported that different emotions can have different implications for wellbeing outcomes or pro-environmental behaviour (e.g., Ágoston, Urbán, et al., 2022; Landmann, 2020; Stanley, Hogg, et al., 2021; Zeier & Wessa, 2024). Thus, the holistic approach we took in constructing the WCARS could be contributing to a weaker predictive power of wellbeing outcomes. As we did not differentiate between the various climate emotions, the effects of certain emotions (such as anger; see Stanley, Hogg, et al., 2021) could be negating the effects of other emotions on illbeing, whereas the HEAS-13, a measure more focused on the core anxiety experience than our measure, emerges as a stronger predictor.

Despite the insufficient incremental validity of the WCARS, we believe it could be a valuable tool, mainly due to its wide content representation. The use of a general score to identify the severity of a person's climate anxiety and predict relevant outcomes was unsatisfactory; however, the WCARS items still hold value as a set of awareness-raising questions. The experts who took part in Study 2 appreciated the ability of the scale to bring unacknowledged thoughts, feelings, and other impacts to the foreground, particularly in a therapeutic context. The WCARS could be used by health professionals who suspect their clients are struggling with climate anxiety to guide conversations during therapy, or even as a checklist of symptoms, instead of relying on a scale score. In particular, the items tapping into functional impairments (8, 11, 12, and 13) had the highest item locations, indicating they are placed higher in the hierarchy of symptoms (Hannachi et al., 2024). A recent longitudinal study suggested impairment-based symptoms may develop from affective-based responses to the climate crisis (Chan, Lin, et al., 2024). Therefore, high scores for these five items could indicate more intense and prolonged climate anxiety and can be used as flags for people who might be more in need of clinical help, as was highlighted by the experts in Study 2. Items from the WCARS could also be used in exploratory or descriptive studies to measure the prevalence of different symptoms or subclinical manifestations of climate anxiety, particularly in the Global South (with the appropriate adaptations), where awareness is still building. Researchers, communication professionals, and environmental organizations could use individual items in large-scale, quick turnaround surveys of subsets of the population, to illustrate to a wide audience how climate change can influence how people feel, think, and behave, and the impacts it can have on their day-to-day lives.

Limitations and Future Directions

In both Studies 1 (60.6%) and 3 (87.3%) we obtained high exclusion rates of participants. MTurk data has been known to be vulnerable to bots and poor-quality responses, which could impact the validity of results (Aguinis et al., 2021; Rosellini & Brown, 2021), a concern that has been raised in climate anxiety scale development (see Owczarek et al., 2025). We employed various methods to flag suspicious responses following the recommendations of recent reviews (Aguinis et al., 2021; Rodriguez & Oppenheimer, 2024) which we believe contributed to the quality of the sample. Still, it is possible the methods we used were overly conservative, and we do not rule out the possibility of false-positive exclusions.

Another potential concern is the size and diversity of the samples. This issue has also been raised in regard to the development of other measures of climate anxiety (Owczarek et al., 2025). Insufficient sample size may have influenced the number of items retained in Study 1b (some items did not have all response categories with at least one response, and were therefore excluded; Wind & Hua, 2022) and our ability to accurately estimate latent paths in Study 3 (as evidenced by the non-convergence of our first latent model, see Kyriazos, 2018). Most participants in Studies 1 and 3 were also white, leading to very uneven subgroups for the DIF analysis. This can have implications for the estimation of parameters in the smallest subgroup and for the comparison of parameters between subgroups (see Wind & Hua, 2022).

Future studies could use our mixed-methods methodology to develop a measure that focuses more on the adaptive outcomes of climate anxiety. This could include reverse-coded items from the CC-DIS and the ICE-Enthusiasm subscale, or measures tapping into positive aspects of climate anxiety (e.g., Li & Monroe, 2018). Study 2 showed how health experts were interested in having a scale like the WCARS for their practice. There are concerns about how prepared mental health practitioners are to approach climate anxiety cases (Pitt & Norris, 2024; Williamson et al., 2025). A future study could use the WCARS items in mental health settings (e.g., during psychotherapeutic sessions) and use other short self-report measures (such as the Session Rating Scale, Duncan et al.,

2003) to analyse whether the items helped strengthen the therapeutic alliance or advance the goals set by the person, which could be helpful to increase their knowledge and self-confidence in climate-related cases. Ultimately, regarding the measurement of climate anxiety, we echo the recommendations of other methodological review studies (e.g., Owczarek et al., 2025; Ramsay et al., 2025) to further validate existing measures of climate anxiety. This would include using representative samples, including multiple measures to assess incremental validity of relevant outcomes, and seeking feedback from experts (and respondents as well) to further refine the measures for specific populations.

Conclusion

We developed a climate anxiety measure, the WCARS, from items belonging to existing measures of this construct. While the WCARS was rated as relevant by experts and correlated to illbeing similarly to other established measures, it was not a better predictor of this outcome. Thus, it is not useful enough to justify adding it to an already fragmented field. Still, some items from the WCARS could still be valuable to experts working with climate anxiety, as well as the methodology we used to develop the scale.

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Chapter 6

So far in this thesis, I have focused on establishing a clear conceptualization of climate anxiety and how to best capture this multidimensional phenomenon. In the previous chapter, we found that a more holistic measures of climate anxiety, despite covering more dimensions, is not necessarily a better predictor of key outcomes compared to other narrower measures (in this case, the HEAS-13). With this knowledge, I now turn to my thesis' other overarching goal, the mapping of climate anxiety in the population.

The study presented in this chapter is the first study to use a validated measure of climate anxiety to measure this phenomenon in a representative sample of New Zealanders. The measure selected, the Hogg Climate Anxiety Scale (Hogg, Stanley, & O'Brien, 2024), is a version of the HEAS-13 specific to climate anxiety (as opposed to eco-anxiety), and was selected based on its superior psychometric performance in the study from Chapter 5. Furthermore, the present study deepens scholar's understanding of the conceptualization of climate anxiety by examining its wider nomological network, meaning what variables predict it (antecedents), and how climate anxiety predicts key outcomes (consequents). Importantly, while so far I have only focused on one climate anxiety outcome, that being individual wellbeing, this study introduces another key outcome: planetary wellbeing, which can have a more complex association with climate anxiety (see Ojala et al., 2021).

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The Supplementary Materials for this chapter are available in Appendix F.

Prevalence and Nomological Network of Climate Anxiety in a Representative New Zealand Sample

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Abstract

Climate anxiety – negative emotional reactions to climate change – has been linked to poorer psychological wellbeing and has shown to have mixed associations with pro-environmental behaviour. Although a growing number of studies have examined the correlates of climate anxiety, few have investigated its prevalence in national samples. Addressing this gap, we used the Hogg Climate Anxiety Scale to measure levels of climate anxiety in New Zealand. Using a representative sample by age, ethnicity, gender, and region (N = 429), our goals were threefold: (1) measure the prevalence of climate anxiety in the New Zealand population and across the 16 regions; (2) examine the associations between climate anxiety and both sociodemographic variables and psychological wellbeing; and (3) clarify whether the correlation with pro-environmental behaviour fits linear versus non-linear models. Overall, 5.2% (95% CI [3.4; 7.8]) of participants reported experiencing climate anxiety, and .5% (95% CI [.0; 1.8]) reported nearly daily climate anxiety, with the highest prevalence observed in the Bay of Plenty region, and highest severity in Southland. People who experienced climate impacts, those working in environment-related jobs, those who felt less prepared for climate change, and younger people reported higher climate anxiety. Those with higher climate anxiety also reported greater psychological distress, reduced wellbeing, and more engagement in pro-environmental behaviours. We discuss potential strategies for supporting at-risk groups, and ways to capitalize on the benefits of climate anxiety while preventing its maladaptive consequences in New Zealand.

Keywords: climate anxiety, New Zealand, prevalence, pro-environmental behaviour, wellbeing

Climate change's impacts are being experienced across the world. The Intergovernmental Panel on Climate Change (IPCC, 2023) reports that widespread changes to the natural environment have occurred and will continue to intensify. This intensification will lead to more destructive weather events, like cyclones, floods, and wildfires (Luna & Fernandes, 2025), longer periods of droughts and heatwaves (Jackson et al., 2025), and profound changes to ecosystems (Morton, 2025). The consequences of such impacts also affect mental health through multiple direct, indirect, and vicarious pathways (Clayton & Crandon, 2025; Obradovich et al., 2018; Romanello et al., 2022). Climate anxiety is one of the many negative psychological consequences associated with awareness of the scope and magnitude of climate change (Clayton, 2021; Lawrance et al., 2022; Pihkala, 2022b). It can be described as anxiety-related emotions shaped by the climate crisis (Pihkala, 2024b), though it can include various other mental states (Cianconi et al., 2023; Coffey et al., 2021).

Individuals can experience climate anxiety without having been directly affected by climate change (Dailianis, 2021). According to the theoretical model of climate anxiety (Crandon, Scott, et al., 2024), exposure to climate-related stressors triggers an existential conflict about the survivability of our species and humanity's roles in the climate crisis. This conflict is associated with emotional (i.e., concern, dread, helplessness, grief, anger) and physiological reactions (i.e., increased heart rate, shortness of breath), as well as cognitive and behavioural strategies to manage these reactions. This anticipatory emotional experience can involve both sub-clinical persistent uncertainty, worry, and hopelessness about the future, and symptoms characteristic of anxiety, depression, and stress disorders, such as rumination, anhedonia, irritability, and insomnia (Clayton, 2021; Dailianis, 2021; Pihkala, 2019). While climate anxiety is not itself a psychological disorder and is often seen as a rational reaction to the climate crisis (see Clayton, 2020; van Valkengoed, 2023 for discussions on this topic), it can lead to a reduction in quality of life depending on the adaptiveness of the coping strategies used (Crandon, Scott, et al., 2024).

Our focus was to investigate the prevalence of climate anxiety across the New Zealand population. Identifying population-level mental health impacts of climate change remains a priority for research in this field, particularly to determine which groups are more at risk for experiencing higher levels of climate anxiety (Ojala et al., 2021). Additionally, we examined how climate anxiety relates to two key determinants of adaptation to climate change – individual psychological wellbeing and engagement in pro-environmental behaviour (Clayton, 2020). We begin by presenting research on levels of climate anxiety across different countries, and then specifically in New Zealand, as well as discussing sociodemographic risk factors. We then summarize studies examining how climate anxiety is associated with psychological wellbeing and pro-environmental behaviour.

Prevalence and Risk Factors of Climate Anxiety

Cross-national studies indicate that people report high levels of negative emotions in response to climate change, with notable variation across nations (Collery & Niedzwiedz, 2025; Ogunbode et al., 2022). Worry about climate change, one of the various negative emotional responses that characterizes climate anxiety, appears particularly prevalent (e.g., Ogunbode et al., 2022). In one cross-national study, adolescents and young adults from 10 countries were asked how worried they were that climate change threatens people and the planet, with 59% feeling at least “very worried”, and 45% reporting that it impacted their daily lives negatively (Hickman et al., 2021). Despite results showing people experience a high degree of different negative emotions about climate change, studies focusing on people’s climate anxiety levels—which goes beyond just negative emotions and includes somatic, cognitive, and behavioural reactions, as well as the level of functional impairment associated with these reactions—show these tend to not be high enough to be considered impairing (see Cosh, Williams, et al., 2024). For example, low levels of climate anxiety have been reported in Australia (McLean, 2024; Patrick, Snell, et al., 2022), Canada (Harper et al., 2025), Germany (Hajek & König, 2022b; Wullenkord et al., 2021), Lithuania (Žukauskienė et al., 2025), Portugal (Pinho, 2025a), and the United States (Uppalapati et al., 2023).

In New Zealand, climate-related research has largely focused on beliefs and attitudes, while research on climate anxiety is still developing. Studies show that most people believe climate change is happening and is caused by human activity, with a smaller subset of the population still sceptical of climate change (e.g., Crawley, 2024; Hogg et al., 2021; Milfont et al., 2024; Stanley, Ng Tseung-Wong, et al., 2021). New Zealanders consider climate change an important issue (Ministry for the Environment, 2023a), recognising recent changes in weather patterns, expecting climate impacts to affect them, and indicating concern about it (though levels of concern have decreased since 2023, see Dudding, 2025). In fact, a panel study of the general New Zealand public found that higher levels of climate concern led to greater psychological distress one year later (McBride et al., 2021).

Other studies have focused on the emotions experienced by New Zealanders regarding climate change. One qualitative study found that Wellington residents expressed a mix of worry and hope, given the country's vulnerability to climate impacts combined with its high adaptive capacity (Du Bray et al., 2017). Another qualitative study focused on young climate activists and their emotional journeys, finding that they oscillated between feelings of anger and anxiety, which affected their wellbeing but also fuelled and guided their climate action (Bright & Eames, 2022).

More recently, researchers have started to investigate levels of climate anxiety in New Zealand. One study validated an existing measure of climate anxiety – the Climate Change Anxiety Scale (Clayton & Karazsia, 2020) – finding mean scores of 1.46 (scores ranging from 0 to 5) for the cognitive-emotional impairment subscale and 1.54 for the functional impairment subscale in a subsample of 68 New Zealanders (Feather & Williams, 2022b). A different study using the Climate Change Anxiety Scale (CCAS) in a convenience sample across a 5-month period found participants reported a mean score of 1.17 for a subsample of 183 New Zealand panel participants (McLean, 2024). Another scale was developed in Australia and New Zealand – the Hogg Eco-Anxiety Scale (Hogg et al., 2021) – which assesses anxiety related not just to climate change but also other ecological problems, with scores ranging from 0 to 3. New Zealand undergraduate students reported mean levels of eco-anxiety ranging from .33 (rumination subscale) to .66 (affective symptoms subscale). A different study using the Hogg Eco-Anxiety Scale in a sample of adolescents found mean levels of eco-anxiety ranging from .32 (behavioural symptoms subscale) to 1.1 (personal impact anxiety subscale) (Hathaway, 2022). Overall, these preliminary studies with convenience samples indicate low levels of climate anxiety in New Zealand samples.

In addition to examining the overall prevalence of climate anxiety, another key priority for research on the impacts of climate change is to identify risk and protective factors associated with climate anxiety (Lawrance et al., 2024). Sociodemographic characteristics may increase the vulnerability of certain groups to the negative mental health impacts of climate change (Clayton & Crandon, 2025; Kühner et al., 2025). For example, women are considered to be at increased risk for climate change anxiety due to the typical caregiving responsibilities associated with gender norms, which increase their exposure to climate impacts in some contexts, and compound with the stress associated with climate change (Gayathri et al., 2025; Pinho, 2025b). Both younger and older individuals are also more vulnerable to climate impacts, given their increased exposure and limited psychosocial resources to cope with them (Clayton & Crandon, 2025). Accordingly, meta-analytical studies have found higher levels of climate anxiety for women and younger people, though this may be dependent on other contextual factors, such as living in the Global South (Boivin et al., 2025; Clayton & Crandon, 2025; Kühner et al., 2025; Lewis et al., 2019; Vrooland, 2025).

People with less power in society, such as those with lower socioeconomic status, are also more exposed to climate impacts and lack the financial resources to adapt to climate change (Clayton et al., 2021). Indigenous Peoples, in particular, can face intense changes to environments central to their cultural identity and practices, compounded by ongoing historical political disenfranchisement and colonial trauma, which profoundly impact their wellbeing (Hill & Plume, 2024; Middleton et al., 2020). In New Zealand, climate change threatens fundamental aspects of Māori wellbeing, such as the environment itself, family relationships, cultural practices, and food and financial security (Apiti et al., 2023; Charlton, 2023; D. E. Johnson et al., 2022). Other risk factors include having a liberal political orientation, living in urban areas, having pre-existing mental health conditions, and working outdoors or in environmental fields (Boivin et al., 2025; Clayton et al., 2021; Cruz, 2017; Powell et al., 2025). Finally, being directly exposed to climate change's impacts (e.g., Li & Leppold, 2025; Pinho, 2025) and not feeling adequately prepared for future impacts (e.g., Du Bray et al., 2017) can also contribute to increased vulnerability to the negative mental health impacts of climate change.

The extant literature provides important cross-cultural comparisons of climate anxiety prevalence and helps identify vulnerable groups across different contexts. However, no systematic investigation of climate anxiety prevalence in the New Zealand population is available to date, meaning that it is unclear how frequent and severe climate anxiety is in this country compared to others, and which communities are at increased risk of experiencing mal-adaptive responses to climate anxiety.

Climate Anxiety, Wellbeing, and Pro-environmental Behaviour

Climate anxiety can be significant enough to impact people's psychological wellbeing (see Cosh et al., 2024; Pitt et al., 2023). Maladaptive responses to climate anxiety can be conceptualized on a spectrum, ranging from mild to severe. In more severe cases, people can experience clinically significant symptoms, finding it very difficult to control their emotions, which could lead to severe impairment in functioning and, in extreme instances, self-harm or suicidal thoughts (Hickman, 2020; Pihkala, 2019). Adapting to climate change involves learning to live with the possibility of experiencing these clinically significant symptoms, as people can oscillate in and out of these mental states according to the strategies they use to cope (Pihkala, 2022b). Not only can climate anxiety lead to impairment, but it can also reduce the potential of a person to flourish, experience positive emotions, and feel satisfied with themselves and others (Doherty, 2018). Empirical support for this emerges from a meta-analysis reporting stronger associations between climate anxiety and measures of distress, like symptoms of depression, anxiety, or stress, than with measures of wellbeing, like life satisfaction (Gago et al., 2024).

However, climate anxiety is not necessarily impairing. A person can feel a high degree of anxiety about the climate crisis, and still not experience any significant impact on their daily functioning and wellbeing (Chan, Tam, et al., 2024; Ojala, 2005; Wullenkord et al., 2024). In fact, climate anxiety can have adaptive outcomes (Crandon, Scott, et al., 2024). Termed a form of "practical anxiety" (e.g., Kurth & Pihkala, 2022), climate anxiety can motivate environmentally-friendly behaviours as a way to minimize distressing feelings (Bright & Eames, 2022; Ojala et al., 2021; Verplanken et al., 2020). Some studies have indeed shown that higher levels of climate anxiety are associated with more pro-environmental behaviours (e.g., Heeren et al., 2023; Kühner et al., 2024), but results are often inconsistent (McLean, 2024; Salla et al., 2025; Stanley, Hogg, et al., 2021; van Valkengoed et al., 2023).

An early theory of anxiety may explain the inconsistency in associations between climate anxiety and pro-environmental behaviours. The Yerkes-Dodson law (Yerkes & Dodson, 1908) states that at low and high levels of arousal, behavioural performance is worsened, whereas at moderate arousal levels, behavioural performance is optimal, following an inverted U-shape pattern. In the field of climate anxiety, this means that at low levels of climate anxiety, a person will not care about the environment enough to protect it. At very high climate anxiety levels, they may be so emotionally impaired that they feel paralysed to do anything to mitigate climate change (see e.g., Innocenti et al., 2023; Schwartz et al., 2022). However, at moderate levels of climate anxiety, a person would feel motivated and able to behave pro-environmentally to mitigate climate change. Recent studies have provided some support for the existence of a non-linear, inverted U-shape in the association between climate anxiety and pro-environmental behaviour (Chapman & Peters, 2024; Coates et al., 2025; Hogg, Stanley, O'Brien, et al., 2024; McLean, 2024).

Present Study

Our goal was to assess the prevalence of climate anxiety in the New Zealand population, map climate anxiety levels across the country's 16 regions, and examine climate anxiety's nomological network, including both its antecedents and consequents. We add to existing studies by using a representative sample of New Zealanders, thus including groups who might otherwise be left out in research using convenience samples and improving the generalizability of our findings, and by using a validated climate anxiety measure, allowing for preliminary comparisons of climate anxiety levels across countries.

We collected data from a quota sample (*N* = 429) and used descriptive statistics and population-weighted proportions to quantify and visualize levels of climate anxiety across New Zealand regions, and structural equation modelling (SEM) to examine associations between climate anxiety and the other measures. Previous studies have indicated low levels of climate anxiety; however, as these findings are still emerging and based on non-representative samples, we made no predictions regarding the prevalence of climate anxiety in the New Zealand population, and our pre-registered hypotheses focus instead on its correlates (see https://osf.io/82thd/overview). We predicted that being younger, female, Māori, liberal, of lower socioeconomic status, living in urban areas, working an environment-related job, having a pre-existing mental health diagnosis, being less adapted to climate change, and having been exposed to climate change impacts would positively predict climate anxiety levels. Furthermore, we expected climate anxiety to positively predict psychological distress and negatively predict wellbeing scores. Lastly, we expected climate anxiety to have a non-linear relationship with pro-environmental behaviour, whereby lower and higher levels of climate anxiety were expected to be associated with decreased behavioural engagement, and moderate levels of climate anxiety with increased pro-environmental behaviours.

Method

Participants

Participants were recruited by the online data collection company Dynata. We aimed to recruit a sample of 400 adults (over 18 years old) currently residing in New Zealand, which was representative of the population according to data from the 2018 New Zealand census. We established representative quotas for gender, age, ethnicity, and region, and participants received monetary and loyalty rewards for participating (approximately $1.50 NZD). Our target sample size was based on a combination of considerations for statistical power in SEM with non-normal data (see Kyriazos, 2018) and our financial resources for conducting this study. This study received ethical approval from the ALPSS Human Research Ethics Committee under delegated authority of University of Waikato (HREC[Health]2025#29, accepted May 15th, 2025).

Of the 911 people who started the questionnaire, 32 were identified as bots, and 15 as duplicate responses. Nine were located outside of New Zealand, and three were not over the age of 18. Most of the other rejections were people who did not respond to any questions (*n* = 295), followed by people who failed more than one attention check (*n* = 128). Our final sample comprised 429 participants, with a mean age of 43.88 (*SD* = 17.31). Table 1 shows the full sociodemographic characterization of the sample, including our quota targets for gender, age, ethnicity, and region (additional sample characteristics are reported in Supplementary Table 6.1 and exclusion criteria in Supplementary Text F1).

Table 6.1

Sociodemographic Characteristics of Participants and Intended Quota Targets

	n	Target *n*	%	Target %
Gender				
Female	235	208	54.8	52
Male	192	192	44.8	48
Non-binary / Other	2		.5	
Age Group				
18 – 24	74	56	17.2	14
25 – 34	78	68	18.2	17
35 – 44	80	76	18.6	19
45 – 54	75	76	17.5	19
55 – 64	59	60	13.8	15
+ 65	63	64	14.7	16
Ethnicity [a]				
Other Aboriginal	0	8	0	2
African, Latin American, Middle Eastern	5	4	1.2	1
Asian	51	40	11.9	10
Māori	61	52	14.2	13

	n	Target n	%	Target %
New Zealand European, Other European	330	264	76.9	66
Pasifika	32	28	7.5	7
Other New Zealand	4	4	0.9	1
Region				
Northland	14	15	3.3	3.7
Auckland	156	132	36.4	33.0
Waikato	37	38	8.6	9.5
Bay of Plenty	27	25	6.3	6.4
Gisborne	3	4	.7	.9
Hawke’s Bay	16	14	3.7	3.5
Taranaki	10	10	2.3	2.4
Manawatū-Whanganui	20	20	4.7	5.0
Wellington	51	44	11.9	10.9
West Coast	3	3	.7	.8
Canterbury	55	52	12.8	13.1
Otago	20	21	4.7	5.3
Southland	6	8	1.4	2.1
Tasman	5	5	1.2	1.2
Nelson	5	4	1.2	1.1
Marlborough	1	4	.2	1.1

Note. [a] Participants were able to identify with more than one ethnicity.

Materials

Climate Anxiety

We used the Hogg Climate Anxiety Scale (HCAS; Hogg, Stanley, & O’Brien, 2024) to measure climate anxiety. This scale derives from the Hogg Eco-Anxiety Scale (Hogg et al., 2021), which has been found to have a consistent four-factor structure (see description below; Hogg et al., 2023). Using a four-point Likert-type scale ranging from 0 (*Not at all*) to 3 (*Nearly every day*), respondents report how bothered they were by different problems when thinking about climate change in the previous 2 weeks. The 13 items of the HCAS are organized into four dimensions: affective symptoms (four items; e.g., “Feeling nervous, anxious, or on edge”), rumination (three items; e.g., “Unable to stop thinking about climate change”), behavioural symptoms (three items; e.g., “Difficulty sleeping”), and personal impact anxiety (three items; e.g., “Feeling anxious about the impact of your personal behaviours on climate change”). Scale scores for each dimension are calculated by averaging their corresponding items, with higher scores indicating higher levels of the respective dimension, and an overall score is calculated by averaging all items, with higher scores indicating higher levels of climate anxiety. The HCAS was validated with United Kingdom and United States samples, obtaining excellent fit statistics for the four-factor model, good internal consistency (ω between .70 and .90) as well as correlations supporting the measure’s convergent validity (Hogg, Stanley, & O’Brien, 2024). Our pre-registration included an additional five items from another measure of climate anxiety, the Waikato Climate Anxiety Rasch Scale (Gago et al., 2025a). We chose to use only the HCAS to be consistent with previous studies, but for completeness report results using the additional five items in Supplementary Analyses F1. Results are virtually identical, except we observed a statistically significant non-linear association between climate anxiety and pro-environmental behaviours when including the five items, which we did not find when including just the HCAS items.

Psychological Distress

We measured psychological distress with the Kessler Psychological Distress Scale (K10; Kessler et al., 2002). The K10 includes 10 items (e.g., “About how often did you feel worthless?”) that measure unidimensional non-specific psychological distress in the past 30 days using a Likert-type scale ranging from 0 (*None of the time*) to 4 (*All of the time*), with higher scores indicating higher psychological distress. Andrews and Slade (2001) reported findings from an Australian sample supporting the validity of the K10 as a measure of psychological distress and its suitability for inclusion in national surveys. The

K10 has been used both in various population-level epidemiological studies (including in New Zealand; e.g., Sibley et al., 2020) and in correlational studies of climate anxiety (e.g., Innocenti et al., 2021).

Psychological Wellbeing

We used the WHO-5 Wellbeing Index (World Health Organization [WHO], 2024) to measure psychological wellbeing. This 5-item scale asks the respondent how often they felt a certain way in the previous 2 weeks (e.g., "I have felt active and vigorous"). Its response scale ranges from 0 (*At no time*) to 5 (*All of the time*), with higher scores indicating increased wellbeing. This measure has also been used in large-scale survey studies in New Zealand (e.g., Stahlmann-Brown et al., 2025) and to examine how climate anxiety is associated with wellbeing (e.g., Ogunbode et al., 2022).

Pro-environmental Behaviour

To measure PEBs, we used the Proenvironmental Behaviour Questionnaire (PEBQ) developed by Ágoston et al. (2022). This scale includes 12 different PEBs (e.g., "Using second-hand clothes") and asks participants to indicate how often they engage in each behaviour. Nine of the items are answered using a 5-point Likert-type scale with different answer options depending on the item (e.g., ranging from *Never/Almost never* to *At each meal* for the item "Eating meat"). The remaining three items are answered in a binary yes/no response. Two of the items ("Eating meat" and "Eating dairy products or egg") were reverse coded. We used the single-score approach to scoring the PEBQ (see Ágoston et al., 2024) by dichotomizing the Likert-type items (the two highest categories corresponded to "yes" and the lower three to "no"), and then assigning weights to each behaviour based on their difficulty (their inverse frequency in the whole sample). Then, for each person, the weights of each behaviour they engage in are added together and divided by the sum of weights of all items. This index ranges from 0 to 1, with larger values indicating higher engagement in more difficult PEBs. Though there are conceptual issues with assessing the internal consistency of pro-environmental behaviour scales (see Kaiser, 1998; Mónus, 2021), we report them for the PEBQ to maintain consistency.

Sociodemographic Variables

Lastly, we included a short sociodemographic questionnaire which included items about participant's age, gender, ethnicity, and region of New Zealand they lived in. It also asked participants to describe their political orientation (on a 7-point scale anchored at *Strongly Conservative* and *Strongly Liberal*), their household income, the type of area they reside in (rural, town, or urban environment), whether their occupation involves being in or studying the natural environment, and if they had had a diagnosis of a mental health condition in the past year. Finally, we asked participants how prepared they felt to face the challenges of climate change, and if they or someone they know has been directly affected by the impacts of climate change.

Procedure

Data collection took place online from July to August of 2025 via Qualtrics. Participants were recruited by Dynata through their proprietary national panel and through advertisements and social media. After responding to questions about their sociodemographic characteristics in Dynata's portal, participants were invited to participate in our survey if the corresponding quotas were still open. Before starting the questionnaire, participants were shown an informed consent form with some information about the study, what they would need to do, and their rights. After consenting to participate, respondents completed the sociodemographic questionnaire first, followed by the five measures. The order of presentation of the measures was randomised, as was the order of the items within each scale. Lastly, we presented the participants with an information sheet with more details on the study and how to request further information.

Analysis

We used SPSS (30.0.0.0; IBM, 2024) to conduct descriptive statistics analyses, ArcGIS to depict levels of climate anxiety by region, and MPlus (8.8; Muthén & Muthén, 2017) for our confirmatory factor analyses (CFA) and SEM. As only ethnicity deviated from our pre-determined quotas, we applied rake weighting by ethnicity to increase the representativeness of our sample. This involved specifying our pre-determined quota for each ethnicity in SPSS, which were then used to iteratively adjust the weight of each case until the sample distribution more closely aligned with our ethnicity quotas. Unless specified, all analyses were conducted with data weighted by ethnicity. We then conducted CFAs with each of our measures to assess their proposed model fits.

To assess the prevalence of climate anxiety, we used one-sample proportion tests with 95% confidence intervals. Because no cut-off scores have been proposed for the HCAS (Heinzel et al., 2023), we used a similar categorization process as Harper et al. (2025), where a score above the midpoint of the scale (a mean score of 1.5) is considered as the cut-off for experiencing climate anxiety, and a score of 2.5 as the cut-off for experiencing high severity climate anxiety.

Finally, we ran three separate latent regression models. For the first model, we regressed latent climate anxiety on the 10 observed sociodemographic variables. For the second model, we regressed latent K10 and WHO-5 scores on latent climate anxiety, controlling for mental health diagnosis status. For these two models, we used WLSMV estimation, which is more suitable for non-normal data with categorical indicators, and provides robust standard errors and mean- and variance-adjusted χ^2 test statistics (Brown, 2006; Muthén & Muthén, 2017). Typical model fit cut-off values (CFI/TLI > .90; SRMR < .08; RMSEA < .06) were established assuming ML estimation (Brown, 2006), and we used these cut-offs as guidelines.

For the third model, we used the observed score for the PEBQ as a manifest indicator of the latent outcome variable (F. Mónus, personal communication, September 4, 2025) and regressed this score on latent climate anxiety and the non-linear (quadratic or squared) term of latent climate anxiety. We used a latent moderated structural equation modelling (LMS; Klein & Moosbrugger, 2000) with MLR estimation and Gauss-Hermite integration. This integration method does not provide fit statistics (global model fit statistics are unavailable across approaches; see Brandt et al., 2020) so we analysed the factor loadings of this model and compared the results with more traditional approaches used in previous research (e.g., hierarchical regression; see Hogg, Stanley, O'Brien, et al., 2024), obtaining comparable results (see Supplementary Analyses F1-F3 and Supplementary Table F11). In the latent PEB model, we used full information maximum likelihood estimation to handle missing data, and pairwise deletion for the other analyses.

Results

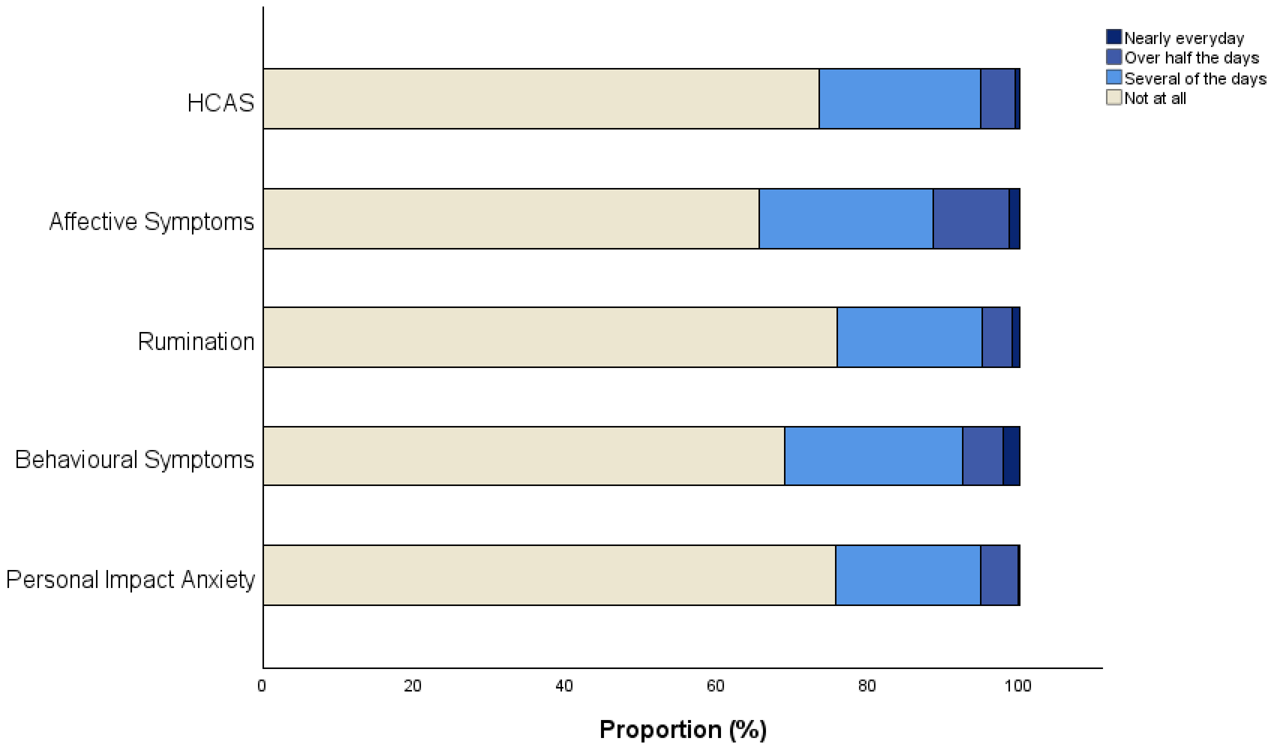
All scales obtained good model fit indices for their original factor structures (see Supplementary Table F2). We tested a second-order factor model in which a higher-order climate anxiety factor is predicted from the four first-order latent HCAS factors, which also obtained good fit. Modification indices indicated residual correlations among two K10 items and among two WHO-5 items. Inspection confirmed these item pairs share content overlap (e.g., WHO-5 item: "I have felt active and vigorous" and "I woke up feeling fresh and rested"), but given the overall good model, we retained the original scale structures without allowing the error terms of these items to correlate. Descriptive statistics for each of the included scales are in Supplementary Table F3. All scales demonstrated good internal consistency and were non-normally distributed with a positive skew. We start by presenting the results for the prevalence of climate anxiety, followed by the latent models to examine its nomological network.

Prevalence

Overall, 5.2% (95% CI [3.4; 7.8]) of participants reported experiencing climate anxiety, and .5% (95% CI [.0; 1.8]) experienced it nearly every day. Figure 6.1 depicts levels of climate anxiety in the New Zealand population, for the overall HCAS score and its four dimensions. Prevalence was highest for affective symptoms (11.4%, 95% CI [8.7; 14.8]) and lowest for rumination (5.0%, 95% CI [3.2; 7.5]). Figures 6.2 and 6.3 show the prevalence and severity of climate anxiety by New Zealand regions. Bay of Plenty was the region where climate anxiety was most prevalent (14.3%), and Southland where it was most severe on average (M = .620; see Supplementary Table F4 for more details, including confidence intervals, and Supplementary Table F5 for the severity of each HCAS dimension per region). When examining prevalence across different sociodemographic groups, we found climate anxiety was more prevalent among younger people, those identifying as Māori, people who live in rural environments, people who work in environment-related jobs, and who have experienced climate change directly (see Supplementary Figures F1a-F1m and Supplementary Tables F6-F7).

Figure 6.1

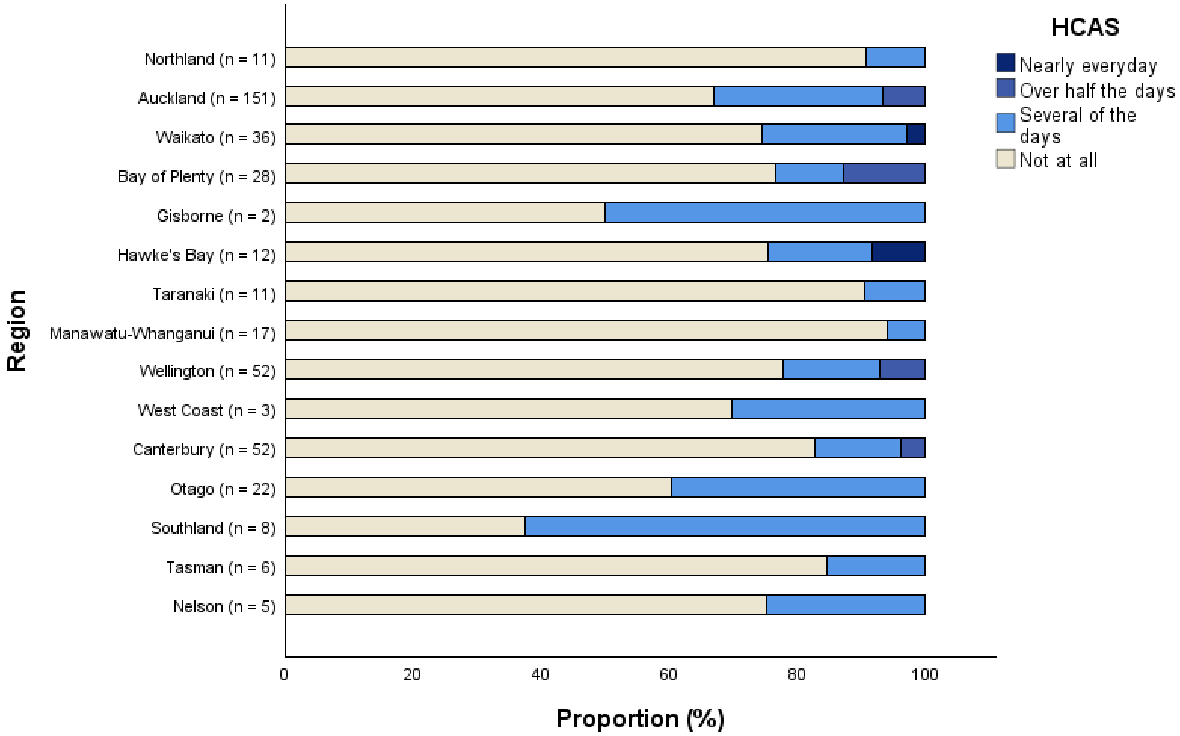
Prevalence of Climate Anxiety in New Zealand



Note. Data weighted by ethnicity. HCAS = Hogg Climate Anxiety Scale.

Figure 6.2

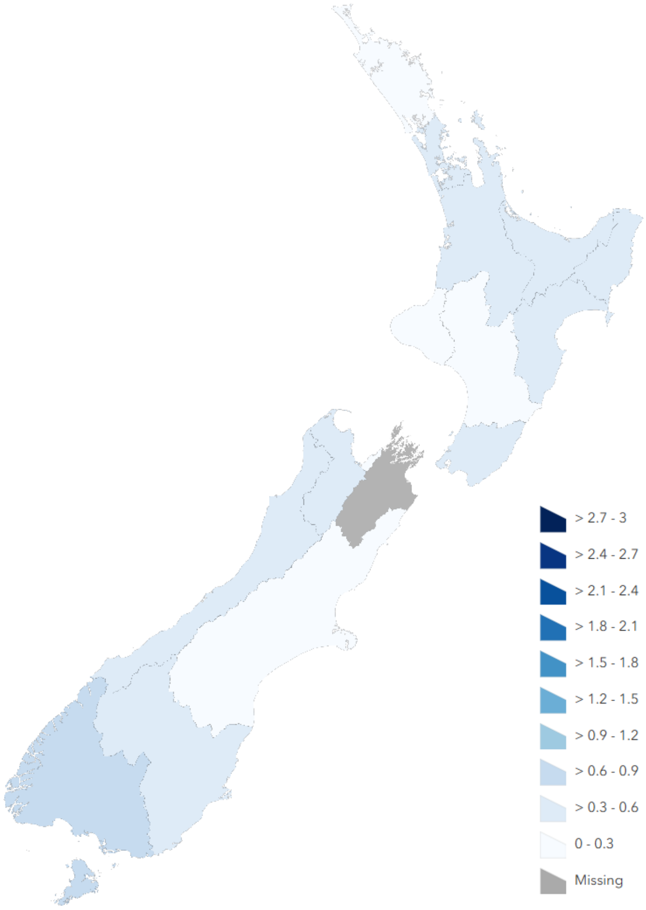
Prevalence of Climate Anxiety by Region of New Zealand



Note. Data weighted by ethnicity. Marlborough was omitted because it had zero participants after weighting the data. HCAS = Hogg Climate Anxiety Scale.

Figure 6.3

Mean Levels of Climate Anxiety (HCAS Scores) by Region of New Zealand

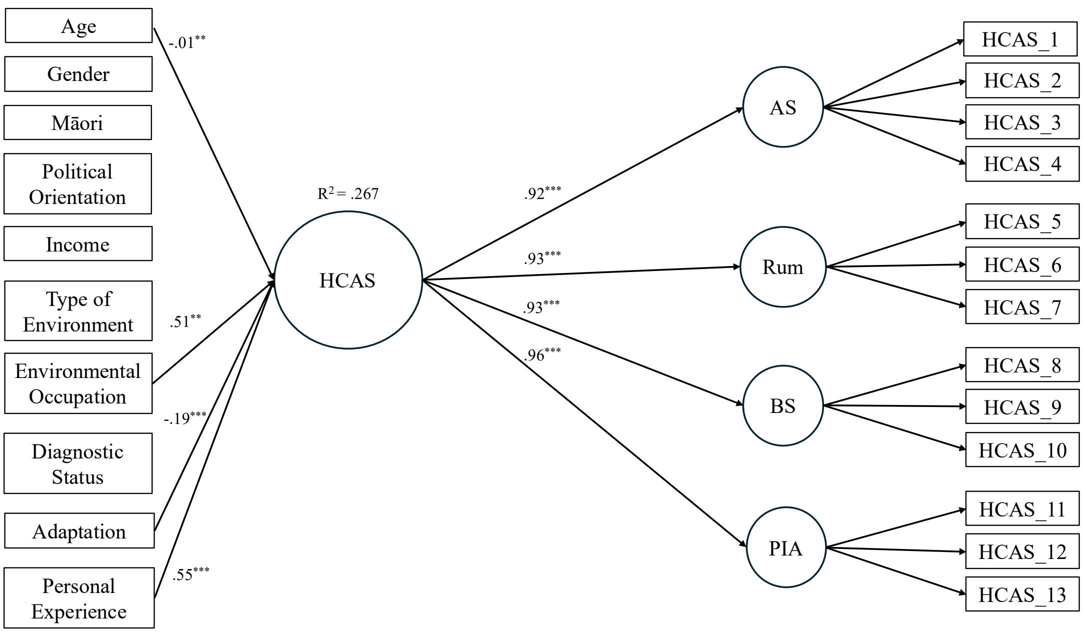


Nomological Network

Supplementary Table F8 shows the bivariate correlations between scales. The latent model predicting climate anxiety from the sociodemographic variables (Figure 6.4) obtained excellent fit: χ^2 (181) = 282.863, p < .001; CFI = .986; TLI = .984; SRMR = .070; RMSEA = .037, p = .997; 90% CI [.028, .045]. People who had experienced climate change impacts, β = .553, p < .001, 95% CI [.305; .801], with environment-related jobs, β = .514, p = .001, 95% CI [.153; .876], who felt less prepared to handle climate change, β = .193, p < .001, 95% CI [.085; .302], and who were younger, β = .011, p < .001, 95% CI [.004; .018], reported higher levels of climate anxiety (see Supplementary Analyses F2 for the nomological network of each HCAS dimension).

Figure 6.4

Latent Path Model with Sociodemographic Variables Predicting Climate Anxiety



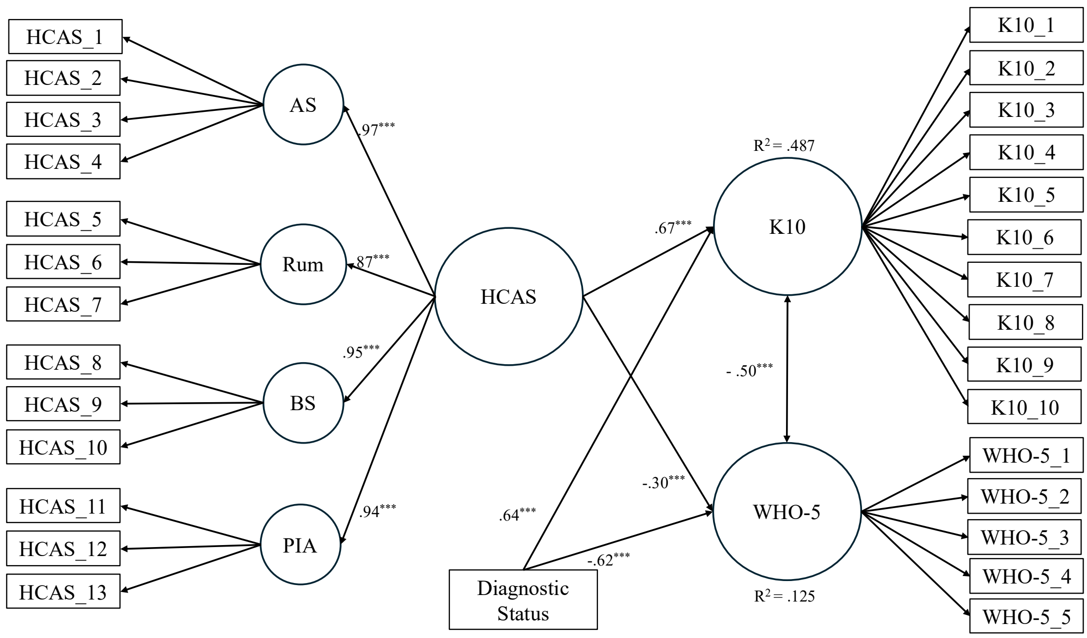
Note. Paths are standardized estimates. Only significant paths are displayed. HCAS = Hogg Climate Anxiety Scale; AS = Affective Symptoms; Rum = Rumination; BS = Behavioural Symptoms; PIA = Personal Impact Anxiety.

* p < .05. ** p < .01. ***p < .001.

The latent model predicting K10 and WHO-5 scores from climate anxiety (Figure 6.5) also obtained excellent fit: χ^2 (369) = 710.081, $p < .001$; CFI = .980; TLI = .978; SRMR = .057; RMSEA = .046, $p = .873$; 90% CI [.041, .052]. Similar to the bivariate correlations, people who reported more climate anxiety experienced more psychological distress, β = .670, $p < .001$, 95% CI [.591; .748], and worse wellbeing, β = -.297, $p < .001$, 95% CI [-.415; -.179], even when controlling for diagnostic status. The model explained 48.7% of variance for psychological distress, and 12.5% for wellbeing.

Figure 6.5

Latent Path Model with Climate Anxiety Predicting Distress and Wellbeing



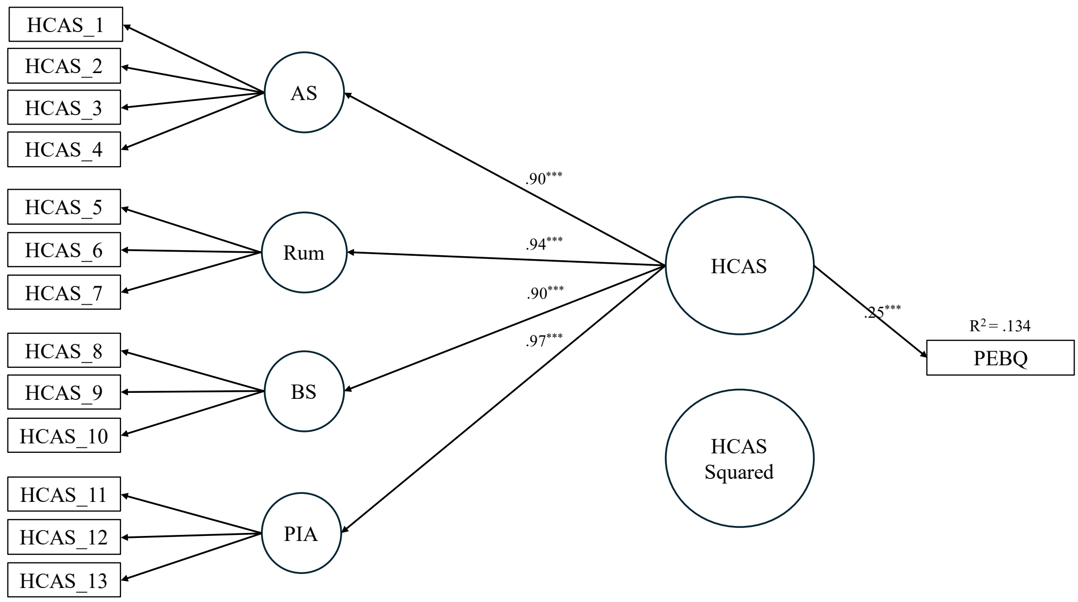
Note. Paths are standardized estimates. Only significant paths are displayed. HCAS = Hogg Climate Anxiety Scale; K10 = Kessler Distress Scale; WHO-5 = Wellbeing Index

$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

In the latent model predicting PEBQ scores from linear and non-linear HCAS scores (Figure 6.6), the non-linear term did not predict PEBQ scores, β = .192, $p = .125$, 95% CI [-.053; .437]. Overall, climate anxiety explained 13.4% of the variance of PEBQ scores. Figure 6.7 depicts the scatterplot for HCAS and PEBQ scores, showing that people who reported having more climate anxiety were also more likely to report that they engage in pro-environmental behaviour. Evidence from other statistical approaches (i.e., the scatterplot, hierarchical regression, and latent product-indicator models) replicated the null association for the non-linear climate anxiety predictor; only the two-line approach (Simonsohn, 2018) suggested a statistically significant non-linear association, indicating stronger engagement in pro-environmental behaviour at higher levels of climate anxiety (see Supplementary Analyses F3).

Figure 6.6

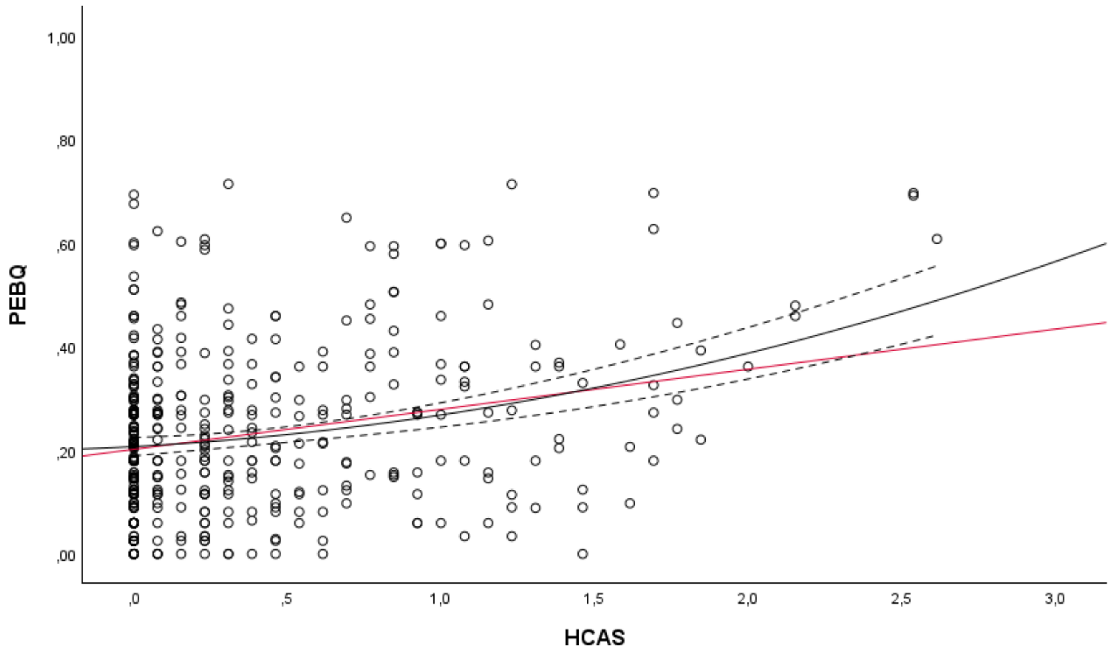
Latent Path Model with Linear and Squared Climate Anxiety Predicting Pro-Environmental Behaviour



Note. Paths are standardized estimates. Only significant paths are displayed. HCAS = Hogg Climate Anxiety Scale; PEBQ = Pro-Environmental Behaviour Questionnaire.
* $p < .05$. ** $p < .01$. ***$p < .001$.

Figure 6.7

Scatterplot for HCAS and PEBQ Scores



Note. Red line represents the linear effect, and the black line the quadratic effect. Dashed lines represent 95% CI. HCAS = Hogg Climate Anxiety Scale; PEBQ = Pro-Environmental Behaviour Questionnaire.

Discussion

While the mental health impacts of climate change are now widely acknowledged (Clayton & Crandon, 2025; Klugger, 2025), few studies have examined the prevalence of climate anxiety in national samples. We contribute to this growing literature by providing the first systematic assessment of climate anxiety across the New Zealand population, examining how prevalent it is, which groups are most vulnerable to it, and how it was associated with psychological wellbeing and pro-environmental behaviours. With recent weather events triggering a renewed awareness of climate change in this country (Ministry for the Environment, 2023b), climate anxiety is suspected to be increasing in prevalence (Ricketts, 2024), and steps are being taken to respond accordingly, such as the establishing of the Climate Psychology Taskforce by the New Zealand Psychological Society (Dixon et al., 2022).

We found that, overall, New Zealanders report low levels of climate anxiety, with our estimates indicating that approximately 1 in 20 New Zealanders experience climate anxiety. This low prevalence and severity is consistent with studies conducted in other countries (Hajek & König, 2023; Harper et al., 2025; Patrick, Snell, et al., 2022; Pinho, 2025a; Uppalapati et al., 2023; Wullenkord et al., 2021; Žukauskienė et al., 2025) and with studies conducted in New Zealand using convenience samples (Feather & Williams, 2022b; Hogg et al., 2021; McLean, 2024). When considering the studies that have used representative samples for their respective populations, our results place New Zealand (5.2%) between Australia (9.4%; Patrick et al., 2022) and the United States (3%; Uppalapati et al., 2023) for climate anxiety prevalence, with Canada (2.4%; Harper et al., 2025) obtaining the lowest and Lithuania (41%; Žukauskienė et al., 2025) the highest prevalence so far. While current prevalence studies have used different climate anxiety measures, preventing a direct comparison, the results suggest that New Zealanders, like people in affluent Global North countries, are not experiencing frequent or severe climate anxiety, and are generally coping with their climate emotions in a way that does not impact their daily functioning.

New Zealand is facing increasing temperatures, more frequent extreme rainfall in the west, droughts in the east, increased wildfires, rising sea levels, and reduced glacier volume (J. B. Lawrence et al., 2023). Despite the projected impacts and the general belief and concern that New Zealanders have about climate change (Milfont et al., 2024; Ministry for the Environment, 2023a), climate anxiety was still low for New Zealanders. The discrepancy between high levels of concern and low levels of climate anxiety has been observed in previous studies (e.g., Feather & Williams, 2022a; McLean, 2024; Whitmarsh et al., 2022) and shows that while New Zealanders recognize climate change to be a serious issue that is likely to occur and is relevant to them, it does not lead to a more personal feeling of worry, or it is not considered a priority compared to other ongoing issues, like cost of living and healthcare access (Crawley, 2024; Ministry for the Environment, 2023b; van der Linden, 2017). This could be because New Zealanders see their country as adequately prepared for the current and future impacts of climate change (Du Bray et al., 2017). Because personal worry and anxiety are more closely linked to anticipatory protective behaviours than concern is (Barlow, 2002; van der Linden, 2017), the low levels of climate anxiety might help explain the low engagement in pro-environmental behaviours we observed in our study.

Climate change is a social justice issue (Clayton, 2021; Office of the High Commissioner for Human Rights, 2015), and accordingly, so are its impacts on mental health (Alarcón Garavito et al., 2024). This means certain groups, usually those least responsible for climate change, will be at higher risk of experiencing more frequent and severe climate anxiety, as well as its maladaptive outcomes (Crandon, Scott, et al., 2024; Ingle & Mikulewicz, 2020). In our study, people who reported having direct experience with climate impacts reported higher climate anxiety, supporting results from previous studies (e.g., Garfin & Wong-Parodi, 2024; Harper et al., 2025; Kühner et al., 2025; Roldán Merino et al., 2025), suggesting that direct experience with perceived climate change impacts can increase the salience of climate risks and trigger negative emotions (Crandon, Scott, et al., 2024; Ojala et al., 2021). For New Zealanders expecting further sea level rise and more frequent and intense storms and wildfires (J. B. Lawrence et al., 2023; Ministry for the Environment, 2023a), climate anxiety might become an increasingly common phenomenon.

Likewise, people working in environment-related fields were more likely to be more climate anxious, supporting results from previous studies (e.g., Dorner et al., 2024; Sapiains et al., 2025). Such occupations can include environmental scientists, farmers, fishing workers, and any other industry that studies or otherwise depends on the natural environment, and the reasons for each person being more climate anxious may differ according to their specific area of work (see, e.g., Head & Harada, 2017; Powell et al., 2025). Environment-related professionals are more exposed to climate impacts, rely on the predictability of the natural environment and can have deeper emotional bonds with nature, making them more susceptible to climate anxiety (Pihkala, 2020b; Weatherly & Doherty, 2025).

Although we found low levels of climate anxiety in New Zealand, it is worth providing proactive support to specific vulnerable groups. Environmental scientists could benefit from emotional management strategies to reduce overwork and burnout (see Burke et al., n.d.; Hoggett & Randall, 2018). Furthermore, people working in the same industry will likely have similar experiences, goals, and concerns. Therefore, they stand to benefit from sharing them amongst each other, either in casual conversations or through more structured programs (see Rodrigues, 2024). Examples include the farmer-focused wellbeing initiative Farmstrong (Farmstrong, 2024), psychoeducation and strengths-based resilience building (Powell et al., 2025), and climate cafés (see De Jong et al., 2025). Acknowledging and validating difficult feelings can help combat the socially constructed silence and isolation that can accompany climate anxiety (Pihkala, 2020b; Weatherly & Doherty, 2025), and promote positive emotions and a sense of community (Head & Harada, 2017). Primary sector workers, one of New Zealand's biggest industry types (Ministry for Primary Industries, 2023), could be further aided by co-developing and implementing tailored adaptation strategies for climate change and other stressors (Weatherly & Doherty, 2025). One ongoing example is He Waka Eke Noa (He Waka Eke Noa: Primary Sector Climate Action Partnership, 2022), a partnership between the New Zealand government, the primary sector, and Māori agrobusinesses, that was established in 2019 with the goals of reducing agricultural emissions while promoting adaptation through increasing sustainable production. Perceived adaptation was associated with reduced climate anxiety in our study, and it could help reduce feelings of uncertainty and increase preparedness for future impacts and perceived control (Stahlmann-Brown et al., 2025).

Despite climate anxiety being reportedly low for most New Zealanders, it is still a problem for some. In our sample, 21 people reported experiencing climate anxiety over half the days, and three of them nearly every day. It is important not to let population-level results overshadow the needs of individuals who might be struggling with the climate crisis, especially as our results support the association between climate anxiety and reduced wellbeing (Gago et al., 2024; Hogg, Stanley, O'Brien, et al., 2024; Kühner et al., 2025; Ogunbode et al., 2022; Roldán Merino et al., 2025). Furthermore, we found climate anxiety has a cumulative effect with other psychological disorders, meaning climate anxiety was not just another manifestation of an underlying broader anxiety disorder, but its own source of distress. Thus, though pre-existing psychopathology did not increase the risk of climate anxiety in our study (cf. Gebhardt et al., 2023; Roldán Merino et al., 2025; Whitmarsh et al., 2022; Wullenkord et al., 2021), people with psychological disorders experience climate anxiety as an additional stressor, further depleting their coping resources and impacting their wellbeing more than for those who do not have a psychological disorder.

The link between climate anxiety and wellbeing could be particularly important for New Zealand, where about 1 in 16 people experience severe anxiety or depression symptoms (Ministry of Health, 2024). With climate anxiety expected to increase as climate change worsens (Crandon, Scott, et al., 2024; IPCC, 2023), it could eventually lead to an increase in people seeking psychological support (see McBride et al., 2021), which could strain an already under-resourced mental health system (Macinnis-Ng et al., 2024). While the New Zealand Psychological Association has acknowledged the potential impacts of climate change on mental health, psychologists may not feel adequately prepared to help people with climate anxiety (Pitt & Norris, 2024). Including climate anxiety in clinical program curriculums and into accreditation competencies (Pitt & Norris, 2024), and promoting discussions of climate emotions among clinicians to increase their climate awareness and competency (Pitt et al., 2024), could be beneficial to preparing professionals for working with people struggling with climate anxiety in the future (e.g., Gebhardt et al., 2025). Other potential strategies to increase the mental health system's capability to deal with climate anxiety impacts could include monitoring climate-related mental health (particularly in regions more vulnerable to climate impacts), considering climate anxiety in mental health system planning, piloting evidence-based mental health intervention programs, and providing proactive and easily-accessible clinical and self-help resources to those in need (Lawrance et al., 2024; Newnham et al., 2020).

Clinicians should also be mindful that unlike psychological disorders, climate anxiety can contribute to positive consequences. Our results support findings from other studies showing that climate anxiety is associated with greater pro-environmental behaviours (Heeren et al., 2023; Verplanken et al., 2020; cf. McLean, 2024), an important part of the efforts to prevent further environmental degradation. However, we did not find the expected inverse U-shape relationship. Instead of an eco-paralysis effect, our results indicated a primarily linear association. We also found some evidence that could suggest the existence of a non-linear association inverse to what we expected, whereby instead of an eco-paralysis effect, people who were highly climate anxious engage in even more pro-environmental behaviours. Still, we only observed this finding in a subset of our supplementary analyses (see Supplementary Table 11), and the extant literature supports an inversed U-shape association (Chapman & Peters, 2024; Coates et al., 2025; Hogg, Stanley, O'Brien, et al., 2024; Lukacs et al., 2023; A. Roberts et al., 2025), so these findings should be taken with caution.

According to the transactional model of coping (Lazarus & Folkman, 1987), eco-paralysis can occur when the threat is appraised as too great for a person's coping resources, either because they cannot come up with viable ways to act on the threat or they do not believe themselves to be capable of successfully reducing the threat (e.g., Innocenti, Perilli, et al., 2023; Innocenti, Santarelli, et al., 2023). New Zealanders behave pro-environmentally primarily because of a desire for building a better life, finding ways they can save their family money while also helping the environment (Ministry for the Environment, 2023b). Being environmentally responsible is seen as central to being a New Zealander (Milfont et al., 2020), which is reflected in a strong sense of collective responsibility and efficacy to act and low perceived barriers to behave pro-environmentally (Ministry for the Environment, 2018, 2023b). These factors could contribute to strong appraisals that New Zealanders can and should do something about climate change, helping them ward off any potential paralysing effect of climate anxiety.

So far, we have discussed ways to curb climate anxiety and its negative impacts from an individual-level perspective. Ultimately, focusing on recommendations for individuals only goes so far, and system-level intervention is necessary (Chater & Loewenstein, 2023). For climate anxiety, this means going beyond seeing it as a shortcoming of the person and holding accountable the parties and systems responsible for their role in the climate crisis (see Berry et al., 2018). In a recent New Zealand survey, 57% of people said businesses should do more to mitigate climate change, with 62% believing the government and individuals should also take more action (Dudding, 2025). Implementing stronger climate policies, such as harsher fines for polluters or stronger pushes for transitioning to renewable energies, could complement individual-level changes in limiting the spread of debilitating climate anxiety without overburdening people and individualizing a global problem (O'Gorman, 2024).

Limitations

While our study offers valuable insights, it is not without limitations. First, while our pre-registered sample size is considered sufficient for our models (see Brandt et al., 2014; Kyriazos, 2018), it was insufficient to adequately estimate the prevalence of climate anxiety by New Zealand regions. This issue was particularly relevant for the less populated regions, like Marlborough, Gisborne, and West Coast, which had few participants, resulting in wide confidence intervals. Therefore, these regions could have different levels of climate anxiety from the ones we obtained. Second, as our sample was recruited via an online panel, rather than using random sampling, potential bias arising from the recruitment method cannot be ruled out. Third, we observed a floor effect for the HCAS, with 40.6% of participants obtaining the minimum possible score. Similar issues have been raised for the Climate Change Anxiety Scale (Lutz et al., 2023; Wullenkord et al., 2021) indicating the HCAS may also be less sensitive to milder forms of climate anxiety like the ones observed in our New Zealand sample (see Gago et al., 2025). Fourth, given the cross-sectional design of this study, the implicit causal links between the antecedent sociodemographic variables and climate anxiety, as well as between climate anxiety and the three outcome measures, should be seen as tentative, requiring further testing to be fully established. This should be done using experimental and longitudinal designs, which explicitly state the hypothesized causal links a priori, identify confounding variables to control for (e.g., using direct acyclic graphs), explore the robustness of their assumed causal links, and consider alternative explanations for the observed associations (see Grosz et al., 2020).

Finally, the questionnaires we used, although previously employed in New Zealand (Hogg et al., 2021; Sibley et al., 2020; Stahlmann-Brown et al., 2025), still originate from a Western perspective on the natural environment and psychological wellbeing. Consequently, the Western concept of climate anxiety does not reflect indigenous ontologies, and does not fully capture the deep emotional and spiritual connection Māori and Pasifika people have with the natural environment, and how this is reflected in their wellbeing (Tupou et al., 2023). For example, community-level impacts, the loss of land, of connection to ancestors, and of shared history, were considered by Pacific mental health and climate experts as important aspects of the environmental crisis (Newport et al., 2024; Tiatia et al., 2023), despite none of these impacts being reflected in the HCAS. Thus, our study could be underestimating the mental health impacts of climate change for Māori and Pasifika in New Zealand, and future researchers on this topic should include and centre indigenous voices and ontologies (Newport et al., 2024).

Future Directions

Our study establishes that New Zealanders report low levels of climate anxiety, and climate anxiety is associated with worse wellbeing and more pro-environmental behaviours. Still, little is known about the specific coping strategies New Zealanders are using to manage their climate emotions. Exploring these strategies could explain the low reported levels of climate anxiety, or why we did not observe the expected eco-paralysis effect (Ojala et al., 2021). Combining this focus with a person-centred approach (e.g., Chan et al., 2024; Wullenkord et al., 2024) could provide information about different profiles of climate anxiety in New Zealand which would be valuable for more tailored intervention strategies.

Furthermore, our study provided a snapshot of levels of climate anxiety in the general population at a specific point in time. Future studies could consider the longitudinal assessment of climate anxiety, using the HCAS or other relevant measures, in the New Zealand population. Given the differences between reported levels of climate concern and anxiety in New Zealand, such longitudinal studies could be important not only to monitor its prevalence, but also to examine its temporal stability, how it changes within-person over time, and how it longitudinally impacts other relevant variables, such as wellbeing or pro-environmental behaviour intentions (see McBride et al., 2021 for a practical example focusing on climate concern).

Lastly, future studies should also focus on the small group of New Zealanders reporting clinically significant levels of climate anxiety. While only 5.2% of participants in our representative sample reported significant impairment, more people are seeking help for their climate anxiety (Ricketts, 2024). Studies could examine the prevalence of clinically significant climate anxiety and qualitatively explore the experiences of highly climate anxious people to investigate the individual and contextual factors that most contribute to maladaptive outcomes.

Conclusion

As anxiety about the impacts of climate change becomes an increasingly common phenomenon across the world, it is important to understand how the public is feeling about the climate crisis, and the consequences of these emotions. We found climate anxiety is not a widespread phenomenon in New Zealand. People who have experienced climate impacts and those working in environment-related jobs were more likely to be anxious about climate change. Furthermore, people with higher climate anxiety reported lower wellbeing, though they also engaged in more pro-environmental behaviours. While climate anxiety may not currently be a salient issue for most New Zealanders, it could become both another source of debilitation for people, and a valuable tool for mitigating climate change.

Chapter 7

The wide-ranging consequences of the global climate crisis have resulted in a rise in anticipatory reactions across the world (see Flynn et al., 2024). These climate anxiety reactions have increasingly been the focus of academic investigation (Momenpour & Choobchian, 2025), but the research has been fragmented (Boivin et al., 2025). My thesis had two overarching goals: to contribute to the conceptualization of climate anxiety by integrating the various reactions to climate change that people report and to add to the measurement and monitoring of climate anxiety levels in the general population.

I started by integrating emerging reviews and models of climate anxiety in Chapter 2 to present my holistic conceptual conceptualization of this phenomenon. Climate anxiety was defined as a non-pathological threat-related affective response to present or anticipated climate-related stressors, involving multiple emotions, cognitive-behavioural responses, and existential conflicts, which together can lead to more adaptive or mal-adaptive outcomes to individual and planetary wellbeing. Then, in Chapter 3, I contributed to this consolidation effort by quantitatively summarising 25 studies examining the association between climate anxiety and psychological wellbeing (Gago et al., 2024). High levels of climate anxiety were associated with lower levels of wellbeing, particularly when the sample had stronger environmental identities and when studies used measures of distress. One reason could be because the items from the specific climate anxiety measure we examined, the CCAS (Clayton & Karazsia, 2020), shared too much content with items from measures meant to capture psychopathological symptoms.

Thus, in Chapter 4, we qualitatively examined the content representativeness of six existing measures of climate anxiety, and found that not only did they differ in the specific climate anxiety features they captured, but these measures also differed from gold-standard domain-free measures of psychopathology by focusing more heavily on the nuances of specific affective states, like anxiety and sadness, instead of on physiological arousal symptoms. Nonetheless, our quantitative findings (using intercorrelations and exploratory latent factor analysis) showed that although the climate anxiety scales differed in content, they all measured the same underlying climate anxiety experience. Therefore, in Chapter 5, we used a mixed-methods, three-step procedure to develop a comprehensive climate anxiety scale from the best functioning items of existing measures. While the resulting Waikato Climate Anxiety Rasch Scale (WCARS) covered the various features included in our conceptualization of climate anxiety, it did not predict psychological wellbeing better than an established measure of eco-anxiety, the HEAS-13 (Hogg et al., 2021). Still, the WCARS's structure followed Rasch assumptions, making it a useful tool to differentiate between levels of climate anxiety at the higher end of the spectrum of climate anxiety responses. Furthermore, the experts we interviewed saw value in the content representativeness of the WCARS's items, which could be used to complement existing measures.

In Chapter 6, we used a validated climate anxiety measure, the HCAS (Hogg, Stanley, & O'Brien, 2024) to examine levels of climate anxiety in the New Zealand population using a nationally representative sample, thereby contributing to ongoing efforts in monitoring climate anxiety levels across the world. We found that 5.2% of participants reported experiencing climate anxiety, with the Bay of Plenty being the region with the highest prevalence (14.3%). Furthermore, people with direct experience of climate impacts, those whose work depends on the environment, and people who did not feel prepared for climate impacts reported higher climate anxiety levels. In turn, those who reported higher climate anxiety levels also reported lower wellbeing, higher distress, and higher engagement in pro-environmental behaviour, highlighting the variety in potential outcomes of climate anxiety in New Zealand and the absence of an eco-paralysis effect. In the following section, I discuss how the findings from these studies relate to one another, and the implications of their overall contributions to the conceptualization and measurement of climate anxiety, extending upon some of the conclusions discussed in the previous chapters.

Disentangling the Dimensions of Climate Anxiety

Scholars have disagreed regarding how they conceptualize climate anxiety, particularly when it comes to the specific responses that should be considered part of this phenomenon (see Kurth & Pihkala, 2022). As presented in Chapter 2, integrated frameworks of climate anxiety have identified some of its distinct features, which include not just anxious affect but also other emotions, cognitive-behavioural responses, and existential conflicts (Watson et al., 2025). Some scholars have argued that these processes are closely interlinked, and have proposed mechanisms for how they interact to produce the overall climate anxiety experience (Crandon, Scott, et al., 2024). In fact, scholars have argued against studying the different dimensions of climate anxiety separately because of how difficult it is to isolate them (e.g., Boivin et al., 2025; Crandon, Scott, et al., 2024). We found some support for this argument in Chapter 4, by empirically demonstrating that different measures of climate anxiety and neighbouring constructs, each covering different aspects of the climate anxiety experience, clustered together (see also Hempel et al., 2025). Thus, conceptually, climate anxiety (and by extension, its measurement) should encompass these various dimensions (see Boehme et al., 2024; Watson et al., 2025), and doing so should provide a more valid assessment of a person's climate anxiety (see, e.g., Chan, Tam, et al., 2024; Hannachi & Somat, 2026).

However, while that perspective suggests that the climate anxiety dimensions cluster together, other findings challenge this assumption. In Chapter 5, we found that the WCARS, a measure designed to cover a broader array of climate anxiety experiences and represent it as a single climate anxiety score, was not unidimensional (see Supplementary Table E17; cf. Hannachi & Somat, 2026), suggesting that the measure captured an affective dimension and an impairment dimension of climate anxiety. Therefore, despite these dimensions being strongly correlated (r = .740), they should not be represented as a single score, despite this being a more parsimonious approach. One reason is that these two dimensions of climate anxiety can have different correlation patterns with relevant variables (see Chan, Tam, et al., 2024; Wullenkord et al., 2024). In the case of the WCARS, this was demonstrated by the impairment dimension having stronger correlations with distress and life satisfaction (r = .773 and r = .180, respectively) than the affective dimension had with these variables (r = .679 and r = .056).

Furthermore, the WCARS was a worse predictor of psychological distress than the HEAS-13, which focuses specifically on anxious affect, rumination, behavioural symptoms, and personal impact anxiety. While these correspond to multiple dimensions of my conceptualization of climate anxiety, they still only represent a subset of these features, and not the full array, and therefore should have lower explanatory power compared to a more inclusive measure, although we found the opposite in our results. We speculated that the comparatively lower predictive power of the WCARS could be because of our amalgamation of climate anxiety dimensions into one higher-order climate anxiety factor, which would mask the unique contributions of each dimension to psychological distress and wellbeing. We found preliminary empirical support for this hypothesis in Chapter 6 (cf. Figure 6.5 and Supplementary Figures F3 and F8). In this study, despite its good fit to the data, a higher-order climate anxiety factor negatively predicted life satisfaction and positively predicted distress and pro-environmental behaviours, whereas examining the effects of each dimension revealed differences in how each of them predicted these outcomes. I elaborate more on these differences and their implications in the next section. Thus, while the various climate anxiety dimensions may be correlated and sometimes cluster together, they have differential impacts on outcomes, and therefore, should not be assumed to all be contributing in the same way to the adaptiveness of the overall climate anxiety response.

Altogether, the findings from my thesis corroborate Kurth and Pihkala's (2022) assertion that the amalgamation of distinct but co-occurring processes into the umbrella term of climate anxiety misrepresents the unique effects of each process. The multidimensionality of the climate anxiety response should be acknowledged, but its dimensions are best examined concurrently and distinctly (see also Boivin et al., 2025; Crandon, Scott, et al., 2024), not as a unitary climate anxiety response. To add conceptual and methodological clarity about the various terms used to describe vicarious reactions to climate change, it would therefore be beneficial to use the label "climate anxiety" only when referring to the milder or stronger forms of the core threat-related affect that characterize this experience (see Pihkala, 2022c, 2024b). Instead, using the broader term of climate distress to refer to the multidimensional response to awareness of the climate crisis still accomplishes the goal of encompassing different degrees of intensity, while limiting confounding distinct processes (see Vercammen et al., 2025)[3].

In practice, this means that a unidimensional holistic measure like the WCARS, that subsumes various dimensions into a single climate anxiety score, may be an overly simplistic way of assessing climate anxiety's nomological network. A more appropriate alternative for this type of analysis could involve using separate measures for each climate anxiety dimension, now that they have been integrated into more unified frameworks. For example, to differentiate between affective and impairment-related dimensions of climate anxiety (see Chan, Tam, et al., 2024; Wullenkord et al., 2024), researchers could use measures like the ICE (if considering a broader array of eco-emotions; e.g., "I feel anger when I think of politicians who delay efforts to mitigate climate change.") or the CCWS (if targeting specifically threat-related emotions, e.g., "I worry about how climate change

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[3] For consistency, I will continue using the term climate anxiety instead of climate distress for the remainder of this thesis.

may affect the people I care about"), which are both affect-based measures, and use the CCAS (e.g., "Thinking about climate change makes it difficult for me to concentrate.") or HCAS (e.g., "Feeling anxious that your personal behaviours will do little to help fix climate change.") to capture the impairment associated with climate anxiety (see Hempel et al., 2025; Vercammen et al., 2025; Wullenkord et al., 2021).

As for the cognitive-behavioural coping strategies that may be part of the climate anxiety response, researchers could use the ECO-SHADOW (e.g., "I've been thinking of other ways to interpret the climate change problems."), a recently published inventory that distinguishes between nine proactive, reactive, or stress-relieving coping strategies for regulating climate anxiety: eco-consciousness (e.g., action), conflict (e.g., ambivalence, self-blame), outcast (e.g., isolation), spirituality-bodily practice, hope, apathy, doom (e.g., catastrophization), overplay (e.g., humour), and withdrawal (e.g., emotional avoidance). To my knowledge, climate anxiety's existential and socio-ecological dimensions are not reflected in existing measures, but measures examining these dimensions could be developed based on the findings from existing qualitative studies and reviews on these topics (e.g., Budziszewska & Jonsson, 2021; Passmore et al., 2023; Rehling, 2022 for the existential dimension, and Crandon, Thomas, et al., 2024; Patrick et al., 2023 for the socio-ecological domain).

Using a set of separate scales explicitly aimed at capturing specific dimensions of climate anxiety could prove more beneficial to scholars' efforts in mapping the relationships between dimensions, and how they relate to other constructs (Watson et al., 2025), as well as to developing a comprehensive case conceptualization in clinical settings (Marks & Hudson, 2024). This selection should be theoretically justified and context-specific. For example, clinical assessments would need to include impairment-related measures and coping-related measures, as well as existential measures, as these are most relevant for the stress response and more closely related with individual wellbeing outcomes (Crandon, Scott, et al., 2024; Lazarus & Folkman, 1987). Prevalence studies, on the other hand, should prioritize affect and impairment-related measures, to avoid potential floor effects while also quantifying the mental health impact climate change is having on the population (see Chan, Lin, et al., 2024; Whitmarsh et al., 2022). As these integrative frameworks emerge, scholars can select specific measures for each dimension and systematically examine how they are associated, contributing to a clearer understanding of the mechanisms underlying the complex multidimensional climate anxiety response, the factors that influence them, and their consequences.

Naturally, not all assessments of climate anxiety require a holistic approach to capturing climate anxiety, or it may not be practical to do so. For example, experts in Study 5 highlighted the importance of a measure of climate anxiety being short and easy enough to implement into a psychotherapy session. Likewise, large-scale prevalence studies may not have the resources to use a large battery of climate anxiety measures, or they may just be interested in assessing climate anxiety impairment, or the strategies used to cope with it. In these situations, the use of properly validated single-score scales is still the most appropriate approach. Our findings from Chapter 4 extend upon existing research supporting the idea that existing scales are closely associated and therefore can be expected to provide similar results (see Hannachi & Somat, 2026; Hempel et al., 2025). Hence, the use of an overarching single-scale is still an appropriate, parsimonious way of describing a sample's overall reaction to their awareness of climate change. However, while this approach has descriptive value, without a more nuanced assessment, it is insufficient for any judgments regarding the adaptive value of such a reaction. Therefore, it is important to be clear about which dimension of climate anxiety is being assessed, and explicitly link any findings to this dimension specifically, instead of to the broader concept of climate anxiety.

Climate Anxiety is Both Disabling and Practical

Having established that climate anxiety is a multidimensional phenomenon, I now turn to discussing how these dimensions are associated with individual wellbeing and planetary wellbeing, and whether climate anxiety is a practical or disabling anxiety. In Chapter 2, I briefly presented the potential outcomes of climate anxiety, often represented in a spectrum ranging from maladaptive symptoms of psychopathology to adaptive forms of behavioural engagement, active hope, and feelings of connection (e.g., Crandon, Scott, et al., 2024). Because of this wide range of possible outcomes, there has been a long-standing debate about whether climate anxiety should be considered a psychological disorder (see Clayton & Crandon, 2024; Kurth & Pihkala, 2022; van Valkengoed et al., 2023).

Before diving into this topic, a caveat should be noted about the cross-sectional design of the thesis and its limitations for causal reasoning. Throughout the studies in this thesis, particularly in Chapter 6, there is an implicit causal logic assuming that the sociodemographic variables we tested as antecedents cause changes in levels of climate anxiety, which in turn causes changes in distress, wellbeing, and pro-environmental behaviour. This is based primarily in theories of anxiety (e.g., Barlow, 2002), theoretical models of climate anxiety (Crandon, Scott, et al., 2024; Pihkala, 2022b), and network analysis studies (Chan, Lin, et al., 2024; Heeren et al., 2023), which all support the implicit causal paths we hypothesised. This theoretical and empirical body of work provide some backing to the findings from this thesis to go beyond simply establishing the existence of statistically significant associations between our variables, hopefully offering more valuable and actionable insights that contribute to the advancement of the field.

Still, it is essential to note that we did not follow all the required steps to ensure that the causal assumptions underlying these links are fulfilled (see Grosz et al., 2020). Because no variables are manipulated in cross-sectional designs, it is impossible to establish that changes in the predictor variable precede the change in the outcome, and that they are the true cause for the changes observed in the outcome (instead of the other way around), meaning we are unable to fully test causal associations. Specifically, in this thesis, we did not identify or controlled for the effect of confounding variables which could explain changes in both the predictor and outcome variables in our models (apart from the presence of a preexisting mental health diagnosis when predicting distress and wellbeing). For example, high trait neuroticism may make a person more vulnerable to experiencing both high levels of climate anxiety and higher levels of domain-free psychological distress (see McCall et al., 2026; Nolen-Hoeksema & Watkins, 2011). Likewise, if it is socially normative to both feel anxious about climate change and behave pro-environmentally, then that social norm may explain why people reporting high climate anxiety tend to behave pro-environmentally (Clayton & Crandon, 2024; Fielding & Hornsey, 2026). Not testing these alternative explanations means we cannot confidently state that climate anxiety leads to both of these outcomes. Similarly, we also cannot rule out the inverse causal paths, that people reporting higher levels of general distress or engaging in more pro-environmental behaviours experience higher climate anxiety as a result. Accordingly, the conclusions in this thesis regarding risk factors of climate anxiety or its effects on wellbeing and behaviour should be qualified as conditional, provided they are supported by future explicit tests of the causal network between these variables and relevant confounders using experimental and longitudinal designs. With this disclaimer in mind, I discuss these provisional results below.

The findings from my thesis showcase the variety of outcomes associated with climate anxiety. First, in Chapter 3, we established that climate anxiety impairment (as measured by the CCAS) was strongly associated with symptoms of psychological distress. We extended these findings in Chapter 5, with the HEAS-13, and in Chapter 6, using the HCAS, while also controlling for pre-existing mental health diagnoses. Overall, these results indicate that climate anxiety impairment is consistently linked to psychological distress, mental illbeing, and psychopathological symptoms. Other systematic reviews and meta-analysis published since corroborate this conclusion (see Cosh, Ryan, et al., 2024; Gebhardt, Westermann, et al., 2025; Kühner et al., 2025). Moreover, they indicate that climate anxiety impairment is not solely impacting people who are already struggling with their mental health (cf. Nezlek & Cypryańska, 2024), which is a common talking point for those discrediting climate anxiety as a valid experience (see Pihkala, 2020a).

Nonetheless, as argued in the previous section, it is necessary to disentangle the effects of each dimension of climate anxiety on wellbeing. In Chapter 3, we showed that for the CCAS, the association between climate anxiety impairment was consistent for both measure's subscales, cognitive-emotional impairment and functional impairment. However, in Chapters 5 and 6, using the HEAS-13 and HCAS, respectively, there were differences in how each of the scales' four dimensions were associated with wellbeing outcomes. Specifically, rumination consistently predicted lower symptoms, lower distress, and, in Chapter 5 only (see Supplementary Figures E5 and F8), it also predicted higher wellbeing. This effect has been reported in other studies using these scales (Ali et al., 2024; Hogg, Stanley, O'Brien, et al., 2024), adding to its robustness. On the other hand, other dimensions have more mixed results, but affective and behavioural symptoms scales tend to predict more symptoms and lower life satisfaction, whereas personal impact anxiety is inconsistently associated with these outcomes (Ali et al., 2024; Cárdenas et al., 2026; Hogg, Stanley, O'Brien, et al., 2024; Roldán Merino et al., 2025).

The role of rumination, meaning the inability to stop thinking about climate change and its impacts (Hogg et al., 2021), as beneficial to wellbeing is particularly noteworthy, given previous reviews highlighting rumination as one of the unconstructive aspects of climate anxiety (e.g., Ojala et al., 2021). Outside of the environmental domain, uncontrollable rumination has been linked to negative affect (Kirkegaard Thomsen, 2006) and mental illbeing (Olatunji et al., 2013; Zhao et al., 2025). Finding similar results, Hogg, Stanley, O'Brien, et al. (2024) hypothesized that repeated thinking about ecological problems may distract from other more personal stressors, or alternatively, occur primarily for people who are not struggling with emotional issues to begin with. Given that the effect remained even when controlling for diagnostic status (see Chapter 6), it seems like rumination's benefits to wellbeing are not dependent on a person's domain-free emotional challenges.

Importantly, repeated thinking about climate change does not necessarily include solely negative thoughts. Some aspects of rumination (e.g., brooding, focusing on unachieved goals) are associated with negative outcomes, whereas other aspects (e.g., reflection and analysis of a situation to better understand a problem) are not (Kirkegaard Thomsen, 2006; Olatunji et al., 2013). Repetitive thinking has been shown to be related to acceptance and recovery following stressful events and engagement in threat-minimizing anticipatory planning (Watkins, 2008). It may be that the repetitive thinking about climate change reported by participants was not primarily about the losses already incurred or negative views of the future, but instead about analysing how these losses could have been prevented, or how these negative futures could be avoided. These could be considered forms of constructive cognitive problem-focused coping (Watkins, 2008), and important precursors to climate action, a crucial component of successful adaptation to climate anxiety (Pihkala, 2022b).

Furthermore, rumination may also be indicative of positive cognitive reappraisal, as people find ways to change their perspective of the impacts of the climate crisis from focused on losses to one focused on hope, trust in others, and the potential benefits that going through such a challenge may bring to society in the future (Ojala, 2016). This form of meaning-focused coping is particularly helpful in the context of uncontrollable threats like climate change (Ojala et al., 2021), as shown by one study linking deliberate rumination about a problem to increased feelings of personal growth and resilience (Krys & Reininger, 2023).

Additionally, people may share repeated thoughts with others around them, a phenomenon termed co-rumination. Co-rumination involves repeatedly discussing problems with other people, either face-to-face or online, and despite potentially contributing to internalizing problems, co-rumination may strengthen social connections (Rose, 2021; Spendelow et al., 2017). Climate anxiety can be an alienating experience (Pihkala, 2022b; Rehling, 2022), but this alienation may be counter-balanced by social benefits resulting from disclosure of climate anxiety feelings (Rose, 2021). Sharing these feelings with someone can prompt further discussion about them and mutual self-disclosure, which have been linked to better quality friendships, and in turn, increased life satisfaction (X. Li et al., 2024).

To summarize, the studies in my thesis show that climate anxiety can be related to psychological distress and reduced wellbeing when it reaches a level that generates some degree of functional impairment. While affective symptoms in particular contributed to reduced wellbeing, their effect could be because people who are already anxious about issues in other domains of their lives are more likely to also experience negative affect and anxiety related to climate change (see Contreras et al., 2024; Nezlek & Cypryańska, 2024; Ojala et al., 2021). However, when we controlled for pre-existing mental health conditions in Chapter 6, feeling anxious about one's responsibility in the climate crisis was still associated with increased distress, while being unable to stop thinking about climate change was associated with more positive outcomes, indicating that not all aspects of climate anxiety require some degree of diathetic stress to impact wellbeing. Still, our measures could not discern what type of repeated thoughts about climate change people were experiencing. To test the various hypotheses regarding the adaptive potential of rumination in the environmental domain, a more detailed method of measuring climate anxiety rumination is needed. A finer assessment of rumination could differentiate between the valence (negative vs. positive), content (focused on losses vs. focused on solutions or adaptation vs. focused on meaning), level of construal (abstract, focused on desired goals vs. concrete, focused on specific actions and plans), and social component (individual vs. social) of these repeated thoughts (Crandon, Scott, et al., 2024; Watkins, 2008).

Looking now at the other end of the outcome spectrum, Chapter 6 showed that climate anxiety impairment was also associated with increased engagement in pro-environmental behaviours. While positive associations between climate anxiety and pro-environmental behaviour are expected based on conceptualizations of instrumental climate anxiety (Kurth & Pihkala, 2022) and previous research (Kühner et al., 2025), results in the literature tend to be heterogenous (Kühner et al., 2025; Ojala et al., 2021). This heterogeneity has been hypothesized to be because of an eco-paralysis effect, whereby stronger levels of climate anxiety would lead to reduced behavioural engagement, cancelling out the positive effects of moderate levels of climate anxiety (Innocenti, Santarelli, et al., 2023; Yerkes & Dodson, 1908). However, our results contest the existence of an eco-paralysis effect in the New Zealand population, as we did not observe the expected drop-off in pro-environmental behavioural engagement at higher levels of climate anxiety.

Despite the variety of studies finding evidence of a drop-off (e.g., Chapman & Peters, 2024; Coates et al., 2025; Hogg, Stanley, O'Brien, et al., 2024; Lukacs et al., 2023; A. Roberts et al., 2025), the results from my thesis are in line with literature that suggest only a linear association between climate anxiety and increased behavioural engagement (e.g., Becht et al., 2024; Pavani et al., 2023), with no eco-paralysis effect (Hempel et al., 2025). Our results were consistent when applying a regression approach commonly used in the literature (e.g., Chapman & Peters, 2024) as well as when applying a latent approach, adding to the robustness of our findings. When examining each dimension separately, our results were more inconsistent across approaches, and therefore more difficult to interpret confidently. Using regressions, we found linear associations, but when using latent models, we found no association for rumination, a linear association for behavioural symptoms, and a curvilinear association (U-shaped) for personal impact anxiety. The only other study I found examining quadratic effects for HEAS-13 dimensions reported the expected non-linear associations for all dimensions (Hogg, Stanley, O'Brien, et al., 2024). Notably, using a two-line approach, which is designed to maximize power in detecting U-shape associations, we found non-linear associations for all dimensions, although unexpectedly, higher levels of each dimension were more strongly associated with pro-environmental behaviour, forming only the positive slope of a U-shape association. More research is needed to clarify the shape and strength of these associations.

I will describe three potential explanations for why strong climate anxiety may not lead to a drop-off in behavioural engagement. First, this finding may be because of how unique of a stressor climate change is: global, uncertain, worsening, and requiring the concerted action of multiple people, governments, and nations. Research has shown that when faced with such a threat, people may believe that, collectively, they can do something to mitigate it, despite how ineffective such attempts have proven so far (Fritsche, 2022; Goldwert et al., 2026; Hornsey et al., 2015). This somewhat illusionary form of motivated control can serve as a coping mechanism to counteract the distressing feelings of helplessness brought about by such overwhelming unpredictable threats like climate change. Indeed, perceived behavioural control is considered an important factor influencing behavioural responses both from a general threat and coping perspective (Folkman et al., 1986; Jonas et al., 2014), as well as from a pro-environmental behaviour perspective (Heeren & Clayton, 2026; van der Linden, 2016). Thus, people experiencing climate anxiety may develop stronger control beliefs as a way to curb these feelings, and these beliefs, in turn, facilitate engagement in pro-environmental behaviour (see Hanss et al., 2025). This would be in line with climate anxiety being a practical anxiety that instead of avoidance behaviours, promotes approach behaviours to minimize the threat causing it (Kurth & Pihkala, 2022; Stollberg & Jonas, 2021). One study suggested more severe levels of climate anxiety may have diminishing returns in terms of how much motivated control they induce (Hanss et al., 2025), but some of the preliminary findings in Chapter 6 (namely the two-line regressions, see Supplementary Figures F11a-F11d) hint at the opposite: that people with higher levels of climate anxiety may have stronger motivated control beliefs, to counteract their increased distress. Similar results have been reported in a sample of Canadian adolescents (Turcotte-Tremblay et al., 2024). As we did not measure control beliefs, this remains only speculation and should be investigated further.

Second, an alternative, or perhaps concurrent explanation (see Bamberg & Möser, 2007), is that the linear link between climate anxiety and pro-environmental behaviour may be because of the moral imperative of climate action, as illustrated by young climate activists in Poland, who saw their activism as a moral and practical necessity given the current climate crisis, to protect theirs and vulnerable others' futures (Budziszewska & Głód, 2021). Research has shown that people's worry about climate change is associated with feelings of betrayal related to the failures of powerful others to mitigate this crisis (Henritze et al., 2023; Hickman et al., 2021). This infringement, considered a form of other-related moral injury, is associated with feelings of outrage and anger (Böhm, 2003; Marks & Hudson, 2024; Pihkala, 2022c). Compared to anxiety, anger related to climate change has been consistently linked to pro-environmental behavioural engagement (e.g., Contreras et al., 2024; Stanley, Hogg, et al., 2021). Furthermore, climate distress may originate from one's own moral conflict over their own role in contributing to the climate crisis, a form of self-related moral injury more associated with anxiety, guilt, and shame (Henritze et al., 2023), the latter two of which have also been linked to pro-environmental behaviour (e.g., Bechtoldt et al., 2026; Kovács et al., 2024). These different moral emotions are often difficult to distinguish from climate anxiety (see Pihkala, 2022c) and, as evidenced by our findings in Chapter 4, can cluster together. Thus, these moral emotions may still contribute to pro-environmental behavioural engagement (see Goldwert et al., 2026) even for highly anxious people, preventing eco-paralysis.

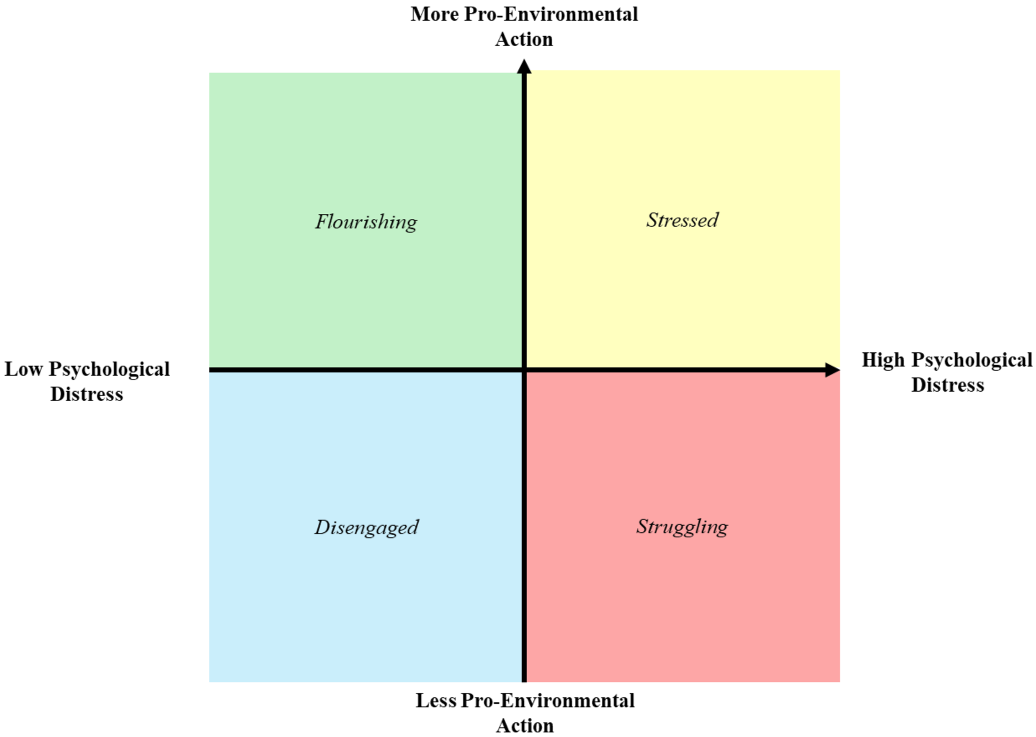
Lastly, a different explanation for the absence of an eco-paralysis effect in our findings relates to the low prevalence and intensity of climate anxiety in our sample. As evident in our scatterplots (see Figure 6.7 and Supplemental Figures F10a-F10d), most participants were on the lower end of the climate anxiety spectrum, meaning the statistical power to detect a drop-off effect at the higher end was reduced, as evidenced by the larger confidence intervals. This hypothesis has also been raised regarding Turcotte-Tremblay et al.'s (2024) results (see Hanss et al., 2025). It could be that the eco-paralysis effect is only present in very high levels of climate anxiety impairment that are not easily capturable in general public studies. Still, our two-line regression results, which should limit this problem, suggest that people increasingly behave more pro-environmentally as they become more anxious about climate change. Therefore, the low prevalence hypothesis seems more unlikely.

To summarize this section, the findings from my thesis support the conceptualization of climate anxiety outcomes as a spectrum. In some cases, particularly when some level of impairment is reached, climate anxiety can be associated with psychological distress and reduced wellbeing; however, it can also have adaptive outcomes, including reducing psychological distress (through more beneficial forms of rumination) and by motivating engagement in pro-environmental behaviour through motivated control or via moral emotions like anger and guilt, which prevent any paralysis effect caused by excessive climate anxiety. Therefore, climate anxiety can be both disabling and practical, depending on the level of impairment, how a person thinks about climate change, and the predominant emotions they experience. Because of this, using a person-centred approach when assessing climate anxiety at a population level, may be more insightful than focusing on associations between climate anxiety and other variables, given how these may depend on moderators that are not being captured (e.g., see the heterogeneity levels in Chapter 3). Researchers have successfully used person-centred approaches to categorize participants into groups according to their levels of climate beliefs (Chryst et al., 2018; Milfont et al., 2024), emotions (Kovács et al., 2024), and impairment (e.g., Hogg, 2025; Ojala, 2005; Wullenkord et al., 2024), using these groups to then test how other variables predict group membership. These approaches could lead to more actionable insights about which groups of people require more support, as I discuss below.

A useful framework to test would be whether there are different groups of people according to how adaptive or maladaptive their climate anxiety is for themselves and for the planet. As we found in my thesis, climate anxiety may be associated with both psychological distress and pro-environmental behaviour, two uncorrelated outcomes (see Supplementary Table F8). Therefore, using a single-axis spectrum (e.g., see Christodoulou et al., 2024; Crandon, Scott, et al., 2024) may not be sufficient to represent the adaptiveness of climate anxiety outcomes, as it can have conflicting effects for individual wellbeing and for planetary wellbeing. Separating these two key outcomes into two orthogonal axes may thus better represent how adaptive an individual's or population's climate anxiety is (see Figure 7.1).

Figure 7.1

Orthogonal Key Outcome Framework of Climate Anxiety



The two axes represent the two key outcomes of climate anxiety (Clayton, 2020). The horizontal axis corresponds to the level of climate anxiety related psychological distress that is reported, ranging from minimal to severe and debilitating levels. At low levels, a person may still experience climate anxiety, for example, in the form of anxious affect, but it does not impact their day-to-day. At high levels, a person's daily life is significantly impacted by their climate anxiety; they may be unable to stop thinking about it and experience intense stress, leading to difficulties in work or study, socializing, or sleeping (Hickman, 2024b), experience somatic symptoms (van Valkengoed et al., 2023), or be unable to engage in behaviours they would otherwise (Dailianis, 2021; Doherty, 2018). People on this side of the spectrum do not have a "climate anxiety disorder" but they are more likely to fulfil the diagnostic criteria for other psychopathologies, such as generalized anxiety disorder. While there is no one cut-off value to distinguish between lower and higher levels of climate-anxiety-related distress, these values may be calculated for each measurement context (cf. Cosh, Williams, et al., 2024; H. Li et al., 2026). The vertical axis represents planetary wellbeing, with the lower end corresponding to minimal or no engagement in pro-environmental action, and the higher end to engagement in a variety of different pro-environmental behaviours. The outcome can be adapted to correspond to effectiveness of environmental action, instead of frequency of engagement (see Lange, 2024). Again, cut-offs discerning between low and high levels should be context-dependent and take into account barriers to action. Considering the two axes together, there are four possible groups according to this framework: *flourishing*, *struggling*, *stressed*, and *disengaged*. Maximizing the adaptive potential of climate anxiety means facilitating its contribution to pro-environmental behaviour while limiting its impact on individual wellbeing, thus reaching a flourishing state. Below, I present a brief description of each group, and some considerations for how the framework could be used in practice.

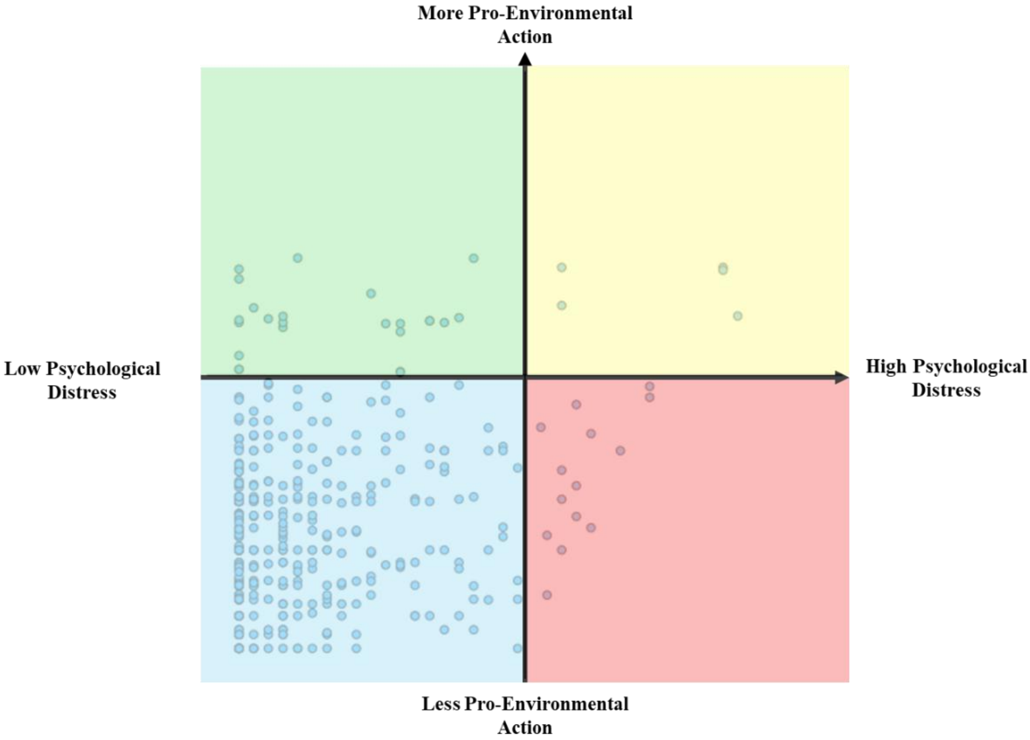
On the top-left corner are the flourishing group, to borrow the term used by (Doherty, 2018). This group includes those who are currently capable of coping with their climate anxiety in a balanced way that provides them not only with the self-care necessary for averting impairment but also engaging in pro-environmental action required for maximizing planetary wellbeing – what Pihkala (2022b) would describe as those who have achieved personal transformations. This would correspond to the most adaptive quadrant of the potential outcomes. On the opposite end, at the bottom-right corner, the least adaptive quadrant includes those who not only feel impaired by their climate anxiety but also paralysed by it. Named struggling, the people here will be finding it challenging to go about their daily lives without it being affected by their climate anxiety, to a lesser or greater degree. As such, they may experience domain-free distress as well. Furthermore, their lack of pro-environmental action may be related to an over-reliance on self-protecting avoidance coping strategies, or because of systemic barriers preventing their engagement; in either case, it is likely to be contributing to their impairment in the long-term.

The main advantage of the orthogonal framework comes from the other two groups, stressed and disengaged, as these represent the conflict between individual and planetary wellbeing that is not represented in existing one-dimensional frameworks. Starting with the stressed group, this includes people who are experiencing some form of distress related to climate anxiety but are still engaging in pro-environmental action. I picked the term “stressed” not because of its psychological connotation (the struggling group is also stressed from a psychological perspective), but mainly from a physical perspective of continuous and increasing strain, that in time could lead an object to break. In much the same way, a person from this group is still able to engage in pro-environmental action, yet, it may be impacting their wellbeing (e.g., through feelings of burnout, see Pihkala, 2020b), perhaps because of an overdependence on this type of strategy (Pihkala, 2022b). This group is likely to experience more intense moral emotions and stricter cognitive schemas that maintain engagement despite the high levels of climate anxiety (see Marks & Hudson, 2024). Lastly, the disengaged group comprises the people who do not see climate change as a serious threat, or at least as an issue as salient as other ongoing crises. This group is likely multifaceted, including climate sceptics, people with more pressing concerns (e.g., financial issues, health concerns), and those who are not aware of climate change impacts. Thus, their climate anxiety is low, as is their level of distress and engagement in pro-environmental action.

This outcome framework could be useful when examining the intersection between climate change and wellbeing. For example, at an individual level, the framework can be used in therapeutic settings as a quick and intuitive monitoring tool to track objectives and oscillations. This was something mentioned by one of the clinical experts interviewed in Chapter 5 as a necessity, similar to how other instruments of psychotherapeutic progress are currently used. After an initial assessment, the framework may be used to set objectives (i.e., moving from a struggling state to a flourishing state), and set appropriate strategies (i.e., engaging in more self-care, implementing smaller and more convenient pro-environmental actions). At a population level, the framework could be used to quantify and map the different groups using latent profile analysis, similarly to the Six Americas Survey (Chryst et al., 2018), but with a focus on outcomes instead of attitudes and beliefs. This approach would help identify and tailor the interventions most necessary for these different subsets of the population. For example, if most of the population is disengaged, interventions could aim to increase awareness via communication strategies or increase incentives and reduce barriers to pro-environmental action. However, if most of the public is already stressed, such interventions are likely to have limited effectiveness. In this case, interventions could focus on targeting systemic change (to ease the burden on the individual), creating networks of environmentally engaged people, and promoting more constructive forms of rumination and self-care. Furthermore, the framework could provide insights into the factors predicting group membership and, used longitudinally, could help track how climate anxiety outcomes vary depending on factors like extreme weather events or new climate policies. Figure 7.2 displays how the participants from Chapter 6 would be classified according to the framework, with most falling in the disengaged category. Accordingly, the strategies exemplified above could be well suited to increase pro-environmental behavioural engagement in New Zealand. However, it is important to note that this is not a formal analysis, as this would require further steps to determine what classifies as baseline distress and action levels (which for Figure 7.2 were the midpoints of each scale).

Figure 7.2

Classification of New Zealanders on Key Outcome Framework



The main question is how to get people to reach a flourishing state. As Hogg (2025) notes, it is not as simple as finding ways to make people think more often about climate change (increasing rumination) while controlling the emergence of other forms of impairment (affective and behavioural symptoms), as these dimensions are interrelated and could likely not be separately induced or reduced without affecting the others. Likewise, van Valkengoed et al. (2023) note that climate anxiety is not the only, or even a sustainable fuel to increase pro-environmental action. With both these points in mind, the orthogonal framework could be a valuable tool to study the intersect between climate change and wellbeing in a way that balances the needs of the individual with the needs of the planet.

Low Levels of Climate Anxiety

Given climate anxiety's impact on personal and planetary wellbeing, it is important to closely monitor how prevalent and intense it is for populations of interest, as well as identifying factors that can contribute to positive outcomes (Lawrance et al., 2024). A recent meta-analysis found moderate levels of climate anxiety severity across 60 published studies (corresponding to a third of the maximum possible scores across measures), although with very high levels of heterogeneity between studies (Gallè et al., 2025). Our findings presented in Chapter 6 show a different picture for New Zealand, where climate anxiety is not a common or severe experience, similarly to other countries around the world (Harper et al., 2025; Patrick, Snell, et al., 2022; Uppalapati et al., 2023) but not all (see e.g., Žukauskienė et al., 2025). Overall, epidemiological studies seem to suggest that, presently, climate anxiety is a phenomenon that affects only a subset of people, and only to a mild degree. Still, there is a lot of variability not only in how prevalent and intense climate anxiety can be, but also in how much it impacts people (see Chapter 3), meaning the factors influencing positive outcomes are still unaccounted for. This means that despite the current low levels of climate anxiety, it is still important to closely monitor its prevalence, should it reach significant levels.

Some caveats regarding the low prevalence of climate anxiety should be noted. For one, it is worth remembering that most prevalence studies (including our own study in Chapter 6) use measures of climate anxiety impairment (see Gallè et al., 2025), which represent a more intense form of climate anxiety (see Chan, Lin, et al., 2024), and may underestimate other non-impairing forms of climate anxiety. Second, our finding that direct experience with climate change was one of the strongest and most consistent antecedents of climate anxiety means that its prevalence and severity are likely to increase, as climate impacts become more frequent and intense (WMO, 2025). Third, as discussed in the previous section, climate anxiety can be a relevant resource or burden, so maximizing its adaptive potential has clear benefits. Altogether, this indicates that while climate anxiety may not be the most salient crisis affecting society currently, it is important to ensure it remains at levels that are not disabling, while also capitalizing on existing climate anxiety to motivate pro-environmental behaviour. The benefits of doing so are not only relevant for individuals and their wellbeing, but also for countries. At a national level, monitoring climate anxiety levels and its outcomes using the framework provided in the previous section can help achieve climate targets, pass pro-environmental policy, limit loss of work productivity due to impairment, and reducing healthcare and social services costs (Heeren & Asmundson, 2023; Y. Li et al., 2024; Nkomo-Asare & Adanlawo, 2025).

Given the low prevalence of climate anxiety at a national level, it may prove difficult to justify and implement system level solutions to prevent further deterioration of the environment and the consequential exacerbation of climate anxiety (see Y. Li et al., 2023). Because of the existing barriers for climate action at this level, the findings from my thesis could conceivably be used by other parties to deny the implications of climate change for mental health (e.g., see Dance & Kaplan, 2025). However, we also found certain communities that share a specific risk factor, such as neighbourhoods recently hit by an extreme weather event, or environmental scientists within a research group may experience more frequent and severe climate anxiety (Chapters 3 and 6). As such, instead of national scale intervention, the findings from my thesis could be used to advocate for the implementation of community level intervention. Action at a community level may be easier to justify, tailor, and implement than intervention at a universal level, and be more sustainable, scalable, and effective than intervention at an individual level, while also catalysing action at these levels (Anjum & Aziz, 2025; Mah et al., 2020). From a socio-ecological perspective, a community level approach complements the individual level actionable insights discussed in the previous sections by influencing factors at a mesosystem level (see Crandon, Thomas, et al., 2024). Some examples of potential interventions at this level include funding locally-led community grants for adaptation and recovery, supporting local knowledge systems, building awareness among community members about the impacts of climate change on mental health, and encouraging local government participation and grassroots groups (e.g., self-help groups, faith-based groups, and civic action groups) (Anjum & Aziz, 2025; Hayes et al., 2019; Pitt et al., 2024). Each of these has the potential to increase important resilience factors including social coordination, a sense of community togetherness, belonging, empowerment, and preparedness for climate impacts.

In addition to these practical implications, the findings from my thesis concerning the prevalence of climate anxiety and its nomological network also has implications within academia. Conceptually, these results strengthen the conceptualization of climate anxiety as ranging from a mild experience with minimal impairment to one that can significantly impact a person's daily life (Hickman, 2024b; Pihkala, 2019). Moreover, the low levels of climate anxiety we reported support the need to consider less intense experiences when trying to capture this phenomenon, instead of considering solely more intense states (Pihkala, 2022c). Consequently, the use of a separate term, such as "climate worry", may be better suited to describe low levels of climate anxiety but reflecting the threat-related affect without implying impairment or pathology (see Bhullar et al., 2022; Pihkala, 2020a; van der Linden, 2017). To clarify then, "climate distress" could be used to describe the overall reaction a person has to the climate crisis, encompassing the various dimensions and interrelated processes. The WCARS would then be considered a measure of climate distress, as it captured aspects from the various dimensions of this phenomenon, representing them in a single latent score. However, accurately measuring climate distress would require a multidimensional approach, and it is unlikely that a single score would be a valid summary of such an assessment; instead, a report or case conceptualization (for an individual or group) would be a more appropriate summary. "Climate anxiety" would correspond to the threat-related affective experience, which could be measured using a psychometrically validated measure, such as the ICE (Marczak, Wierzba, et al., 2023). The intensity of the functional impacts associated with climate anxiety can range from the mild and trivial, termed "climate worry", to more intense impairing levels, termed “climate anxiety impairment”. Clinically-relevant cut-off scores for separating these two endpoints can be determined for each measure and population (see Cosh, Williams, et al., 2024; H. Li et al., 2026) and used to calibrate the baseline for the key outcome framework described in the previous section.

Methodologically, our findings highlight a need to find ways of capturing these forms of climate worry. As mentioned, these may evolve into more impairing forms when left unaddressed (Chan, Lin, et al., 2024), so they are worth monitoring as potential precursors of more severe climate anxiety. In Chapter 5, we found that items from existing measures (as well as the final WCARS items) captured only high levels of climate anxiety, which helps explain the floor effects we observed in Chapter 6 and which have been reported in other studies (Hannachi & Somat, 2026; Hempel et al., 2025; Lutz et al., 2023; Wullenkord et al., 2021). This issue was also raised by the experts in Chapter 5, who emphasized that climate anxiety is often experienced more as an unconscious phenomenon, even by people who may already be seeking help for other forms of psychological distress. In addition to the generalized concern about climate change mentioned in Chapter 5, researchers interested in capturing these more subtle forms of climate anxiety can supplement their measures with items capturing momentary affective reactions to climate change (e.g., “tense”, “peaceful”; see Ogunbode et al., 2022), and items tapping into the cognitive appraisal of climate change as a threat (e.g., “I feel a loss of control when I think about climate change and its consequences”; see Wullenkord et al., 2024). Latent profile analysis studies have shown that these items tend to be endorsed by non-impaired participants (Chan, Tam, et al., 2024; Wullenkord et al., 2024), indicating they may be sensitive to less intense forms of climate anxiety. Comprehensive or longitudinal monitoring studies, in particular, should look to include these types of measures, if feasible.

Similarly important is to monitor adaptive forms of climate anxiety. I highlighted in Chapter 2 how models of climate anxiety expect there to be oscillations in how a person feels about climate change, sometimes experiencing deeper distress, and other times, some form of hope about the future (Pihkala, 2022b). These fluctuations were also mentioned by the experts interviewed in Chapter 5. However, as seen in Chapter 4, existing measures predominantly capture the distress reactions (the main exception being the ICE Enthusiasm scale(Marczak, Wierzba, et al., 2023), which includes only four items; Marczak, Wierzba, et al., 2023). Furthermore, in Chapter 3, we showed how a measure of climate anxiety impairment is more strongly associated with measures of domain-free impairment. By the same logic, not capturing the more positive side of climate anxiety reactions means that there may be a systematic underestimation of the adaptive outcomes of such an experience. For example, one study has shown that differentiating between and including both adaptive (in the form of climate hope) and more impairment-based forms of climate anxiety better reflects the overall association between climate anxiety and pro-environmental behaviour (Sangervo et al., 2022). Similarly, other positive aspects of climate anxiety are not being captured by existing measures, such as a greater feelings of meaning, gratitude, empathy, and connection with others and with nature (Crandon, Scott, et al., 2024; Lutz et al., 2023; Vergunst et al., 2024). While this was one of the initial goals of the WCARS, such items were not included in the final measure because they did not fit into our Rasch modelling approach, suggesting that they would require a separate instrument to capture them (as proposed by Crandon, Scott, et al., 2024; Sangervo et al., 2022). Including such a measure in prevalence studies could thus provide a better picture of the overall contributions of climate anxiety to key wellbeing outcomes.

Finally, as mentioned in Chapter 2, existing conceptualizations and measures of climate anxiety are not tailored for capturing the experiences of non-Western people. In Chapter 5, experts from non-Western countries and from countries with ethnically diverse populations raised concerns about this particular issue, especially regarding differences in the salience of the climate crisis between groups, resulting in differences in awareness about impacts and threat appraisals, as well as differences in the variety of dimensions that may be involved in the climate anxiety experience for different cultures. To illustrate some of these differences, in our examination of climate anxiety in New Zealand (Chapter 6), we saw that people identifying as Māori reported more frequent climate anxiety compared to other ethnicities (see Supplementary Figure F1d and Supplementary Table F7), and had a higher likelihood of experiencing behavioural symptoms related to climate anxiety (see Supplementary Figure F8). Despite these results, the fact that the HCAS (or the K10 and PEBQ) were not designed with Māori ontologies and history in mind, it is likely that these results still underestimate or otherwise misrepresent Māori (and other cultural groups') climate anxiety, wellbeing, and pro-environmental behaviour, as mentioned in the limitations section of Chapter 6. Indeed, the neglect of Māori health and wellbeing has been well-documented in New Zealand (Harris et al., 2022), and mirrors similar issues for other Indigenous Peoples across the world (Ford, 2012; Valeggia & Snodgrass, 2015).

As such, the findings from my thesis should serve as a preliminary assessment of climate anxiety of other ethnic groups in New Zealand, showing that there is initial evidence of differences between how these groups experience climate anxiety, and future prevalence studies across the world need to take into account the different ethnicities within the target population, and their specific beliefs regarding the environment and wellbeing. For Māori in particular, some additional dimensions of climate anxiety that should also be captured include historical and social injustices, the deterioration and loss of connection to the land and to ancestors, the influence of their role as custodians of the land (kaitiakitanga), and the impacts on and restorative effects of certain social structures, namely whānau and marae (D. Johnson et al., 2021; McClutchie et al., 2026). This is just an illustration of the unique climate anxiety dimensions for Māori based on our findings from Chapter 5 and the contributions of previous literature. A comprehensive account of all relevant dimensions would require following a Kaupapa Māori approach led by Māori researchers (see McClutchie et al., 2026 for an example of such an approach in examining the health and wellbeing of Māori following an extreme weather event). Likewise, the same is true for any other Indigenous Peoples and cultural groups. While this is beyond the scope of this thesis, the findings reported here serve to emphasize this well-documented research priority (e.g., Boehme et al., 2024; Lawrance et al., 2024).

Applications for Stakeholders

As discussed in the previous section, the studies in my thesis have contributed to the literature on climate anxiety by addressing long-standing questions about its conceptualization, measurement, and prevalence. These contributions were possible through the use of innovative methods in the field of climate anxiety research. I provide an overview of the scientific contributions before moving on to discussing implications for stakeholders.

The multilevel meta-analysis and meta-regressions described in Chapter 3 allowed us to include multiple effect sizes per study controlling for the effect of study-level confounds by assuming non-independence of the data (Harrer et al., 2022). This approach increased the power of the meta-analytical estimates and reduced any bias incurring from having to select a single effect size from each study. Furthermore, our use of sensitivity analyses, such as outlier detection and permutation analyses added to the robustness of the results. The use of Rasch modelling in developing the WCARS, in Chapter 5, also represents a methodological innovation, particularly in the inclusion of a very large amount of items, by locating them along a latent climate anxiety severity scale (cf. Hannachi & Somat, 2026).

Additionally, the use of latent modelling in Chapters 4, 5, and 6 provided estimates of associations between various climate anxiety measures and associated constructs while controlling for measurement error (Brown, 2006). This was complemented by the use of robust estimation methods and fit indices, that accounted for the ordinal nature of the data and its non-normal distribution. In particular, the combination of this latent modelling approach with non-linear estimation methods in Chapter 5 is a new and more advanced way of examining the complex association between climate anxiety and pro-environmental behaviour. Lastly, the overarching care throughout all empirical chapters in providing the raw data, analysis procedures, and supplementary results complies with the transparency and reproducibility guidelines that underly open science principles.

All in all, the robust findings presented in my thesis could be useful to a variety of stakeholders interested in the intersection between climate change, wellbeing, and pro-environmental action. Using an a posteriori informal description of some of these stakeholders based on the 3i (interest, influence, impact) framework by Reed et al. (2025), I briefly outline possible ways that these stakeholders could put my thesis' findings into practice.

Members of local and national government, of international organizations, and other decision-makers in the policy area should be interested in protecting their constituents and putting forth policies favoured by them. They have high direct power over outcomes and over the research process through funding and political influence. Accordingly, they can benefit from the impact of the research in the short-term, by increasing their chances of re-election if their support for pro-environmental policies aligns with their constituents'. Altogether, their high interest, influence, and impact make them key stakeholders in this context (Reed et al., 2025). Policymakers could therefore fund further research into the prevalence of climate anxiety within their territory. In addition to contributing to intergroup comparisons and a better understanding of climate anxiety as a phenomenon, such efforts would be beneficial to monitor and control levels of climate anxiety. Furthermore, the association found between climate anxiety and individual and planetary wellbeing, coupled with these prevalence estimates, could be used to argue for passing pro-environmental policy, as a way to limit the health and economic consequences of impairing climate anxiety. As described in the previous section, this undertaking is especially relevant for local governments of populations at increased risk of climate anxiety.

Pro-environmental organizations and activists have a stronger interest, but more indirect influence than policy-makers. They also stand to benefit more from the impact of the research. Similarly to policy-makers, pro-environmental organizations and activists could use the findings to apply pressure on policymakers and industries to pass pro-environmental policies, as a way to protect people's wellbeing and the state of their local (and global) environment. One such example is Safe Landing (*Safe Landing*, n.d.), a community formed by environmentally-conscious aviation workers and enthusiasts who come together to discuss the intersection between flying and climate change, and find ways of making commercial and private air travel more environmentally friendly (Hibberd, 2025). Their hope is that these assemblies motivate government and industry leaders to include workers in their decision-making processes. Within these different pro-environmental groups, close attention should be paid to the wellbeing of individual members, to ensure they are not in a stressed state, according to the framework described above. In such cases, in addition to a larger emphasis on self-care forms of coping, organizations could encourage more adaptive forms of rumination, given the positive effects found for individual wellbeing.

Depending on their area of care, healthcare workers and clinicians may have more direct interest in the findings, if they are explicitly climate-focused, or a more secondary interest if climate change is only one of many threats to their patient's health and wellbeing. Their level of influence is also secondary, since as a collective they may advocate for more close monitoring and intervention on climate change as a threat to health (see, e.g., J. Roberts, 2025; The New Zealand Psychological, 2019). As such, they can benefit in the short and long-term as resources to manage this threat are made available. Healthcare workers and clinicians should then be aware of the link between climate change and mental health, as well as of the main indicators of impairing climate anxiety, namely more intense anxious feelings about climate change and one's role in it. Given the consistency of the findings regarding climate anxiety impairment and domain-free distress, I emphasize the importance of not minimizing such cases of climate anxiety, even when it may be more of a background concern. In such cases, validation of these feelings and encouraging adaptive forms of rumination are helpful initial areas of intervention (although rumination's role here still requires further exploration). In psychotherapeutic settings, the WCARS items could be used to informally capture various aspects of a client's climate anxiety, not as a scored measure (instead, the HCAS should be used), but as a tool to identify the main dimensions of climate anxiety that the person is struggling with. It may also be used as an awareness-raising tool, in such cases where the therapist suspects there may be an environmental component of the client's presenting issues. The orthogonal outcome framework can then be used to set therapeutic goals and informally track progress on these goals at the end of each session.

Academic researchers, scholars, and educators share the same stakeholder characteristics as healthcare workers and clinicians. They can also use the WCARS' items and the orthogonal framework for population-level research and to inform policy-makers of which interventions can bring the most benefit to their community. The largest benefit to this group comes from the conceptual and methodological contributions for the climate anxiety literature described in the previous section. As an illustration of this research impact, the study in Chapter 3 has been often cited in the literature when establishing the theoretical background of the mental health impacts of climate change, including in a recent annual review by Clayton and Crandon (2025). Furthermore, some of the methodological approaches, namely the incremental validity of the HEAS-13 in predicting distress and the non-linear latent modelling approach, could be reproduced and expanded upon in future research.

Finally, some members of the public, despite their low influence, have underlying values that can increase their interest in the research, and they stand as the ones most likely to benefit from its impacts on the short and long-term. This is the case for the populations we found to be most vulnerable to climate anxiety and its impacts, including those with direct experience of climate change, those in environmentally-dependent jobs or who otherwise depend on the natural environment for their wellbeing, and younger people. The findings from my thesis can increase their awareness of how climate change may already be impacting their wellbeing and show that these feelings are valid and not a sign of psychological weakness, likely shared by others in their community. For Māori in particular, my thesis echoes calls that this group requires Māori-led research to be conducted, and supports the claim that the impacts of climate change on this group are unique and impossible to capture from a Westernized research approach (e.g., Newport et al., 2024). Accordingly, Māori stakeholders can use these findings to campaign for further research to be conducted with an explicit focus on Māori experiences.

Overarching Limitations

Despite the aforementioned strengths, there are some limitations that may have influenced the findings. Some have already been mentioned in the empirical chapters, but in the following paragraphs I discuss their impact in the context of the full set of studies and identify which particular studies may have been most affected by them.

One important limitation concerns the quality of the self-report data collected via online participant pools. This issue affected particularly Chapters 4 and 5, in which we used Amazon Mturk, and, to a lesser extent, Chapter 6, in which we used Dynata panel participants. I initially opted to use these platforms because they allowed me to collect a larger number of responses with the time and financial resources available to me, as well as reach a wider variety of participants from across the world. Furthermore, crowdsourced platforms had been previously used in the environmental psychology (e.g., Helm et al., 2018; Milfont et al., 2025) and the climate anxiety literature (e.g., Chan et al., 2025; Latkin et al., 2022), including in the development of the CCAS (Clayton & Karazsia, 2020). However, the quality of the data collected through crowdsourced platforms, particularly Mturk, has worsened in the past years (Kay, 2025; Rosellini & Brown, 2021). Likewise, during the course of this thesis, it has become easier to use large language models, such as ChatGPT or Google Bard to complete online questionnaires, or for one person to use automated bot farms to receive the rewards for completing the same questionnaires multiple times (Lebrun et al., 2023).

These issues can therefore explain the very high exclusion rates we obtained in our studies (60.6% for Chapter 4 and Study 1 of Chapter 5, 87.3% for Study 3 of Chapter 5, and 52.9% for Chapter 6). Indeed, the exclusions in these studies were primarily because of bot responses, participants that skipped all questions to reach the end of the questionnaire quicker, and failed attention checks. To minimize this issue, we used increasingly more quality control measures with more varied tasks for participants (see Supplementary Table E1), similarly to what has been used in recent studies (e.g., Vercammen et al., 2025). Accordingly, I argue the high exclusion rates we obtained are not a weakness of the studies in itself, but instead a sign of our efforts to ensure that we only retained acceptable data from a participant pool of questionable quality.

What is more concerning is the quality of the first MTurk sample we collected, which was used in Study 2 of Chapter 4 and in Study 1 of Chapter 5. Because this was the first time we used MTurk for this thesis, the criteria for data quality were not as strict (e.g., no collection of duplicate metrics, less varied attention checks). As such, we obtained some questionable results with this sample, mainly in the form of unexpected positive correlations with reverse-coded items, and with a conservative political orientation, as well as higher climate anxiety scale scores than expected for a general public sample. These issues could be signs of straightlining or acquiescence bias, likely exacerbated by the long and repetitive questionnaire. While this issue was minimized in later studies with the introduction of additional quality control metrics, it still calls into question the findings from the affected studies. Still, similar results from other samples may ease some of these concerns. In Chapter 4, we still obtained similar correlation patterns and latent factor results for the university student sample. Moreover, two other recent studies also found evidence of convergence between different climate anxiety scales, specifically the HEAS-13 and the CCAS (Hannachi & Somat, 2026; Hempel et al., 2025), again corroborating one of the main findings in our study. As for Chapter 5, our three-step approach to developing the WCARS ensured we had sufficient information for any decision-making regarding which items to keep or exclude. The inclusion of the student sample, the experts' inputs, and the validation study meant that we were not entirely dependent on the results from that earlier questionable sample.

Studies considering collecting data via online questionnaires should then take into account certain recommendations. First, if feasible, consider distributing surveys through more traditional means, such as through the post, with easy to access links directing participants to the online questionnaire. This approach has been successfully used for developing participant panels in New Zealand, contributing to a variety of cross-sectional and longitudinal research projects (see Sibley, 2025), and in climate anxiety prevalence studies (e.g., Harper et al., 2025). Additionally, using a data collection firm, such as Dynata, or other companies with verified panels (e.g., Prolific, Connect; see Kay, 2025), is a safer alternative than open crowdsourced platforms, as these companies are more likely to have stricter safeguards to ensure participants are human and reliable, and they will have access to more advanced methods of fraud detection, not available in base versions of software for questionnaire development, such as Qualtrics. Such safeguards are essential in ensuring data quality and ultimately save time and money for researchers who would otherwise spend much of their time screening data. Second, include various quality control metrics within the questionnaire. While these are not perfect and more advanced bots may bypass them, they are still able to signal careless responding to a certain degree. Semantic synonyms, bogus items, and open-response self-reflecting questions about the participant's experience in the study were some of the best strategies for filtering inattentive or duplicate responses in our study (see also Abbey & Meloy, 2017; Aguinis et al., 2021; Kay, 2025), together with the embedded metrics provided by Qualtrics and other similar platforms. Third, provide a way for participants to verify their authenticity, for example by providing a unique code at the end of the questionnaire that can be matched to their responses on the survey. This approach carries ethical concerns because it threatens participant's anonymity. Nevertheless, quality control metrics will lead to false-positives, where real participants are erroneously signalled as bots. This also has ethical implications, because participants would not receive their due compensation for their effort, and may have negative implications for their emotional wellbeing and future compensation on the platform. Thus, providing a way to appeal screen-outs could be more beneficial for the participants and allow the researcher to be more confident in their data.

A separate limitation related to the data collection process was the lack of qualitative insights from participants regarding their climate anxiety experiences. This issue affected mainly the item selection process in Chapter 5, as participants were not able to provide their opinions on which aspects of their own climate anxiety experiences were not being represented by the final set of items in the WCARS. While this issue was minimized by interviewing experts in the field, the first-hand experiences of people experiencing climate anxiety may differ from the perceptions of experts, particularly when people have experienced climate impacts themselves (see Chapter 6 and McClutchie et al., 2026) . Experts' contributions, while valuable, may primarily mirror prevailing ideas in the literature, which can contribute to an echo-chamber effect. This issue was mentioned by some of the experts in that study, who emphasized the importance of first-hand inputs in developing models and measures of climate anxiety. Furthermore, participant insight would have enriched the findings from Chapter 6, similarly to the mixed-methods approach used by Schwartz et al. (2023). For example, collecting qualitative data would have allowed us to better understand whether the low prevalence of climate anxiety was related to the existence of more salient concerns, or to participant's adapting to their climate anxiety and coping effectively with it. Qualitative data could have been helpful in understanding how New Zealander's think about climate change, which could have been helpful in explaining the unexpected positive effects of rumination on wellbeing, as well as understanding why high levels of climate anxiety impairment did not lead to eco-paralysis. Finally, it would have been helpful in gaining a clearer understanding of Māori climate anxiety experiences, and how they may not have been entirely captured by our measures.

Lastly, we also were unable to include a subsample composed of highly climate anxious individuals for known-groups validation testing of the WCARS (Chapter 5), or for multi-group analyses in Chapter 6. Comparing a group of participants who had sought therapeutic help for their climate anxiety with participants who did not, or with people who were in therapy for non-climate-related issues would have been helpful for examining whether the WCARS accurately discerned between these groups, and therefore, whether it was indeed capturing climate anxiety and not general distress, corroborating the measure's construct validity (see Davidson, 2014). Furthermore, having a subsample of participants known to have high levels of climate anxiety in Chapter 6 would have allowed us to examine whether the nomological network of climate anxiety was the same for low and high climate anxious people through latent multigroup analyses. This would have permitted us to test whether rumination's positive effects on wellbeing exist across different levels of climate anxiety, or whether the eco-paralysis effect is more apparent at high levels of climate anxiety than at low levels.

Future Studies

As discussed in the previous sections, my thesis has not only contributed to clarifying the conceptualization, measurement, and prevalence of climate anxiety, but has also raised several new questions about it that can be addressed in future studies. I now outline a few of these potential avenues for research that have stemmed from the findings of this thesis.

One approach that would be helpful for corroborating and expanding upon these findings is through the use of qualitative methods to gather more in-depth information. Having established an initial framework of climate anxiety as a multidimensional phenomenon with a wide range of outcomes, researchers can use as a variety of data collection approaches, including focus groups and ethnographic field work with at-risk groups, to test whether this theory of climate anxiety actually reflects people's lived experiences, as well as what might be missing from the conceptualization. Many qualitative studies on the topic of climate anxiety have been conducted before (see Soutar & Wand, 2022, for a review), but these have focused mainly on identifying aspects of people's climate anxiety, not on developing a theory of this phenomenon. Such studies would also be better suited for analysing which dimensions of climate anxiety are more ubiquitous across groups, and where differences between them may exist. For example, does the general public, with its low levels of climate anxiety as we reported in Chapter 6, experience more subtle forms of impairment that are not represented in existing measures? Do they experience existential struggles, and if so, how do they go about resolving them? Do people who have lived through climate impacts first-hand have unique climate anxiety experiences or dimensions, compared to those who have not? Do people perceive their climate anxiety as adaptive, and if so, under what conditions? A qualitative approach would allow for further exploration of these and other aspects which are not as easily captured via quantitative measures.

Another promising research opportunity would include a more in-depth exploration of some of the unexpected results reported here. Two examples include the positive effects of rumination on wellbeing and the absence of an eco-paralysis effect. Starting with climate anxiety rumination and its contribution to wellbeing, researchers can adapt existing rumination measures that better differentiate between different forms of rumination (see Olatunji et al., 2013) to examine which forms of repetitive thinking about the climate crisis may be helpful and which ones may be unhelpful. Research on this topic could follow a correlational design or involve experimental manipulation of the type of rumination people engage in (see Kirkegaard Thomsen, 2006, for examples on manipulating ruminative thoughts in experimental studies). One important question to examine for this topic is whether an intervention aimed at shaping climate-related repetitive thoughts into being more about finding solutions, meaning, and having a more positive valence could lead to more adaptive outcomes. Another possibility involves running network analyses with different forms of rumination (e.g., brooding vs. reflection), seeing which ones are associated with climate anxiety impairment and with pro-environmental behaviour, similarly to how Mouguiama-Daouda and Heeren (2026) tested the effects of inhibitory versus prospective intolerance of uncertainty on these outcomes.

Regarding the lack of an eco-paralysis effect, researchers can examine whether this is also replicated in other populations, particularly when the general public's levels of climate anxiety are higher (i.e., Žukauskienė et al., 2025). Additionally, I raised two main potential explanations for this finding that warrant further exploration. The potential role of motivated control could be tested experimentally, by using messages that increase or decrease (plus a neutral message as a control condition) people's perceptions of individual and collective control (see Hornsey et al., 2015), and examining whether perceptions of control moderate the association between climate anxiety and pro-environmental behaviour, whereby low perceptions of control facilitates the paralysing effect of climate anxiety, similarly to how Gregersen et al. (2021) examined the effects of personal and collective efficacy. The other hypothesis I raised, concerning the role of moral emotions such as guilt and anger, can be tested in a similar way, by experimentally manipulating each of these emotions (see Bechtoldt et al., 2026), and examining their moderating effect on the association between climate anxiety and pro-environmental behaviour. Importantly, in testing both the hypotheses above, researchers will need to consider the non-linearity of this association, which as shown in Chapter 6, may not necessarily be in the expected inverted U-shape, but instead in a positive slope shape.

Lastly, more studies capturing the prevalence of climate anxiety across the world are needed. Findings from these studies would be important for quantifying the mental health impacts of climate change in a way that considers not only direct and indirect impacts, but also vicarious impacts. This would help enrich existing metrics of the ongoing consequences of climate change on health (e.g., Romanello et al., 2025), which currently consider mainly the effects of extreme temperatures and extreme weather events on mental health, and not the affective reactions associated with awareness of climate change, which we have shown can be associated with psychological illbeing. Prevalence studies will need to be more consistent in the terminology used, not just related to which dimension of climate anxiety is being measured, but also the metric that is reported, as often studies report prevalence in the form of mean scores, which would best describe the average intensity of climate anxiety in the population. In my view, both metrics should be reported separately. Prevalence rates provide an easy to understand snapshot of the proportion of people who are being affected by climate anxiety, whereas mean scale scores give stakeholders an idea of how severely people are being affected by climate anxiety. In both cases, it is essential to identify meaningful cut-off scores that can be used together with the outcome framework presented above to classify groups within the population. Given the protective effect of adaptation reported in Chapter 6, the need for prevalence studies is particularly relevant for countries with low adaptive capacity to climate change, such as small island developing states and countries in the Global South, where research on this topic is still lacking (Kühner et al., 2025; Watson et al., 2025).

Conclusion

In a world struggling with the polycrisis, climate change is but one of the many issues that people have to face in their lives. Some experience its impacts more directly and to a greater extent, while others are left to grapple with the existential threat posed by the climate crisis in more vicarious ways. In either case, a threat of this magnitude will almost certainly trigger an affective reaction from people, in addition to the other psychological impacts caused by climate change. As such, psychologists have a duty to aid in the interdisciplinary efforts of combating climate change (APA Task Force on Climate Change, 2022).

In my thesis, I contribute to these efforts by exploring how people are adapting to the prevailing threat of global climate change, and how this may be influencing their ability to mitigate it. Specifically, I focused on climate anxiety, which I defined as the threat-related affective reaction people have in response to climate change, involving a variety of other cognitive, behavioural, and existential dimensions. Although these various dimensions all converge under a general climate distress response, I have shown that they are best conceptualized and measured separately, as they can have distinct effects on key outcomes of climate anxiety. Furthermore, I have shown that climate anxiety can be both an impairing reaction, associated with psychological distress and illbeing, as well as a productive one, linked to engagement in pro-environmental behaviours, even at high levels of anxiety. To account for this finding, I proposed a new framework that conceptualizes the two key outcomes of climate anxiety, individual and planetary wellbeing, as two independent axes, resulting in four potential outcomes of climate anxiety – flourishing, stressed, disengaged, and struggling. Finally, I have shown that climate anxiety levels are still generally low in the New Zealand population, although some groups, namely people who have experienced climate impacts directly, those whose jobs depend on the natural environment, and those who do not feel they are prepared to deal with climate change impacts, may be at particular risk of experiencing higher levels of climate anxiety.

All in all, these findings are relevant for supporting the recognition of climate anxiety as an important factor in the fight against climate change, both for individuals and for countries. Further research is needed to clarify and expand upon the findings reported here, but this thesis represents another step towards integration in a fragmented field. To return to the quote that I started this thesis with, the driver of this vehicle needs to notice that some of its passengers are (rightfully) freaking out, and others are trying to get the driver's attention to slow down and avoid crashing on the fast-approaching corner. It is my hope that if and when they notice, it may be enough to make them ease off the gas pedal a bit.

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Appendices

Appendix A: Co-authorship Statements

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Please indicate the chapter/section/pages of this thesis that are extracted from a co-authored work and give the title and publication details or details of submission of the co-authored work.

Chapter 3 - A meta-analysis on the relationship between climate anxiety and wellbeing

Gago, T., Sargisson, R. J., & Milfont, T. L. (2024). A meta-analysis on the relationship between climate anxiety and wellbeing. Journal of Environmental Psychology, 94 102230. 10.1016/j.jenvp.2024.102230.

Nature of contribution by PhD candidate	Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Visualization, Writing – Original Draft
Extent of contribution by PhD candidate (%)	80%

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Prof. Taciano L. Milfont	Conceptualization, Methodology, Supervision, Writing – Review & Editing

Certification by Co-Authors

The undersigned hereby certify that:
- the above statement correctly reflects the nature and extent of the PhD candidate's contribution to this work, and the nature of the contribution of each of the co-authors; and
- that the candidate wrote all or the majority of the text.

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Chapter 4 - Examining Content Representation and Convergence of Climate Anxiety Measures

Gago, T., Sargisson, R. J., & Milfont, T. L. (2025, August 20). Examining Content Representation and Convergence of Climate Anxiety Measures. https://doi.org/10.31234/osf.io/deqt4_v1

Nature of contribution by PhD candidate	Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Visualization, Writing – Original Draft
Extent of contribution by PhD candidate (%)	80%

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Name	Nature of Contribution
Dr. Rebecca J. Sargisson	Conceptualization, Methodology, Supervision, Writing – Review & Editing
Prof. Taciano L. Milfont	Conceptualization, Methodology, Supervision, Writing – Review & Editing

Certification by Co-Authors

The undersigned hereby certify that:

- the above statement correctly reflects the nature and extent of the PhD candidate's contribution to this work, and the nature of the contribution of each of the co-authors; and
- that the candidate wrote all or the majority of the text.

Name	Signature	Date
Tomás Gago	Tomás Gago	7/1/2026
Rebecca Sargisson	RSargisson	20/02/2026
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This form is to accompany the submission of any PhD that contains research reported in published or unpublished co-authored work. **Please include one copy of this form for each co-authored work.** Completed forms should be included in your appendices for all the copies of your thesis submitted for examination and library deposit (including digital deposit).

Please indicate the chapter/section/pages of this thesis that are extracted from a co-authored work and give the title and publication details or details of submission of the co-authored work.

Chapter 5 - Consolidating Climate Anxiety Scales Using Rasch Modelling

Gago, T., Sargisson, R. J., & Milfont, T. L. (2025, August 6). Consolidating Climate Anxiety Scales Using Rasch Modelling. https://doi.org/10.31234/osf.io/fx3a5_v1

Nature of contribution by PhD candidate	Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Visualization, Writing – Original Draft
Extent of contribution by PhD candidate (%)	80%

CO-AUTHORS

Name	Nature of Contribution
Dr. Rebecca J. Sargisson	Conceptualization, Methodology, Supervision, Writing – Review & Editing
Prof. Taciano L. Milfont	Conceptualization, Methodology, Supervision, Writing – Review & Editing

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Name	Signature	Date
Tomás Gago	Tomás Gago	7/1/2026
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Please indicate the chapter/section/pages of this thesis that are extracted from a co-authored work and give the title and publication details or details of submission of the co-authored work.

Chapter 6 - Prevalence and Nomological Network of Climate Anxiety in a Representative New Zealand Sample

Gago, T., Sargisson, R. J., & Milfont, T. L. (2026) https://doi.org/10.31234/osf.io/vh9ux_v1

Nature of contribution by PhD candidate	Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Visualization, Writing – Original Draft
Extent of contribution by PhD candidate (%)	80%

CO-AUTHORS

Name	Nature of Contribution
Dr. Rebecca J. Sargisson	Conceptualization, Methodology, Supervision, Writing – Review & Editing
Prof. Taciano L. Milfont	Conceptualization, Methodology, Supervision, Writing – Review & Editing

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Name	Signature	Date
Tomás Gago	Tomás Gago	7/1/2026
Rebecca Sargisson	RSargisson	20/02/2026
Taciano Lemos Milfont	Taciano Lemos Milfont	20 Feb 2026

Appendix B: Links to OSF Pages for Studies

Chapter Number and Study Title	Pre-registration	Pre-print	Open Access Data
Chapter 3: A Meta-analysis on the Relationship Between Climate Anxiety and Wellbeing	https://osf.io/gkxm6/overview	https://osf.io/preprints/psyarxiv/eaq4k_v1	https://osf.io/u3r75/overview
Chapter 4: Examining Content Representation and Convergence of Climate Anxiety Measures	Pre-registered as an exploratory analysis in https://osf.io/vyhqg/overview	https://osf.io/preprints/psyarxiv/deqt4_v1	https://osf.io/6etr5/overview
Chapter 5: Consolidating Climate Anxiety Scales Using Rasch Modelling	https://osf.io/vyhqg/overview https://osf.io/jgcbh/overview https://osf.io/gwa8m/overview	https://osf.io/preprints/psyarxiv/fx3a5_v1	https://osf.io/8kp2t/overview https://osf.io/xezqw/overview https://osf.io/p2m4e/overview
Chapter 6: Prevalence and Nomological Network of Climate Anxiety in a Representative New Zealand Sample	https://osf.io/82thd/overview	https://doi.org/10.31234/osf.io/vh9ux_v1	https://osf.io/9pdjv/overview

Appendix C: Supplementary Materials for Chapter 3

Supplemental Material C1

Search Strategy

(Values in parentheses correspond to the number of results yielded by each search)

- Databases searched (92) – search conducted on March 29th, 2023
    - Search strings:
        - "Climate anxiety scale" OR "Climate change anxiety scale"
        - Search starting from 2019
- EBSCOHost (6)
    - All databases, full text
- APA Psychnet (6)
    - All databases, full text
- JSOTR (0)
    - All databases, full text
- Proquest (26)
    - All databases, full text
- Sage journals (0)
    - Full text
- SCOPUS (46)
    - Full text
- SSRN (8)
    - Full text
- Web of Knowledge
    - Couldn't access

- Reference lists examined
    - Clayton and Karazsia (2020), using Google Scholar (292) – March 30th, 2023

- Contacted authors who have published articles using the CCAS and authors who wrote seminal works on climate/eco-anxiety in the past (0) – March 27th, 2023
    - Message:

Hello Dr. ____,
Firstly, I wanted to thank you again for helping us in the early stages of our project. We have since put up a pre-registration for our meta-analysis on OSF, which you can access via this link (https://doi.org/10.17605/OSF.IO/GKXM6), if you are interested in following our progress.
We are continuing our efforts in collecting all the data we can gather on the relationship between climate anxiety and wellbeing. We are now extending our reach even further, by getting in contact with various associations and networks that would be interested in the outcomes of our research. To that end, if you belong to or know of any such collective that aligns with our objectives, we would once again be very grateful if you could share with them the request below.
Thank you for your time and consideration.
Best regards,
Tomás Gago

Dear colleagues,
We are in the process of conducting a meta-analysis of studies that used Clayton and Karazsia's 2020 instrument, the CCAS (the Climate Change Anxiety Scale) to assess climate anxiety and how this variable is related to different measures of psychological

wellbeing, both in the form of negative (such as psychopathology symptoms) and positive indicators (i.e. life satisfaction, positive emotions, ...).
We are looking not only for published studies, but also unpublished manuscripts, preprints, dissertations, conference presentations, raw data, and works in progress that match the following criteria:
- Studies must assess climate anxiety as indexed by the CCAS and at least one measure of psychological wellbeing, defined as adverse effects on mental health and variables indicative of one's ability to flourish
- Studies must provide correlation coefficients, or other data that allows for its calculation (or authors provide usable data upon request)
- Studies must be written in English, Portuguese, or Spanish
If you have any studies or data that may match these criteria (regardless of the study's results) and you would like it to be included in our meta-analysis, we would be very grateful if you would share them with us to the following email address:
tomasoomgago@gmail.com
Let us know how you would like your work to be cited. We would also appreciate it if you could forward this message to any colleagues that are working on relevant research to our project. The pre-registration for this study is available on OSF (https://doi.org/10.17605/OSF.IO/GKXM6).
We will be more than happy to clarify any questions you may have. You can reach us at the email above. Thank you very much for your time and consideration.
Best regards,
Tomás Gago
Dr. Rebecca Sargisson
Dr. Taciano Milfont
University of Waikato, Tauranga, New Zealand

  - A reminder email was sent during data collection requesting access to raw data if no response was received

- Contacted psychological associations across the world – March 28th, 2023 (7)
  - Message:

Dear ____,
My name is Tomás Gago. I am a psychology student from Portugal just starting my PhD at Waikato University in New Zealand, under the supervision of Dr. Rebeca Sargisson and Dr. Taciano Milfont. The topic of my research is climate anxiety, and I am particularly interested in the Climate Change Anxiety Scale as a means of quantifying and examining this phenomenon.
The first stage of my PhD is conducting a meta-analysis of the studies that have used this questionnaire. To that end, we were hoping you could help us circulate the message attached below through your network's mailing list, if you believe it aligns with your goals as well, so we could reach as far of an audience as we can.
Thank you for your time and consideration of our request.
Best regards,
Tomás Gago

Dear colleagues,
We are in the process of conducting a meta-analysis of studies that used Clayton and Karazsia's 2020 instrument, the CCAS (the Climate Change Anxiety Scale) to assess climate anxiety and how this variable is related to different measures of psychological wellbeing, both in the form of negative (such as psychopathology symptoms) and positive indicators (i.e. life satisfaction, positive emotions, ...).
We are looking not only for published studies, but also unpublished manuscripts, preprints, dissertations, conference presentations, raw data, and works in progress that match the following criteria:
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tomasoomgago@gmail.com
Let us know how you would like your work to be cited. We would also appreciate it if you could forward this message to any colleagues that are

working on relevant research to our project. The pre-registration for this study is available on OSF (https://doi.org/10.17605/OSF.IO/GKXM6).
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Best regards,
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Dr. Rebecca Sargisson
Dr. Taciano Milfont
University of Waikato, Tauranga, New Zealand

- APA Div 34
- SASP (responded March 27th; 5)
- EASP (responded April 4th; 1)
- NZPS (responded March 29th; couldn't send out call for data)
- Ora Taiao (responded March 28th)
- CPA
- EPG Groningen
- Ecopsi Portugal
- AASP (responded April 6th, couldn't send out call for data)
- PAPU
- NLPA
- IIAP Div 4
- DGPs (responded March 31st; 1)
- SIP
- Psicamb (responded March 31st)
- SBP (responded April 12th)
- IACCP

- Google scholar alarm for "Climate anxiety"/ "Eco-anxiety" (4)

Supplemental Table C2

Pooled Effect Sizes, Heterogeneity and Moderators of all Meta-Analyses Performed

Meta-analysis	*k*	*s*	*r*	95% CI	Effect-size level τ^2	Sample level τ^2	I^2	Moderators	*β* [95% CI]	*F*(df1, df2)	I^2
Wellbeing											
CCAS	57	23	-.296***	[-.360; -.230]	.010	.022	94.58%	Gender (f)	.004 [-.002; .010]	*F*(1, 53)=1.682	
								Age	-.001 [-.006; .005]	*F*(1, 47)=.094	
								Personal experience	-.007 [-.018; .005]	*F*(1, 12)=1.528	
								PEB	.000 [-.001; .001]	*F*(1, 36)=.000	
								Environmental identity	.011 [.002; .021]	*F*(1, 19)=5.988*	
								Year	.095 [-.002; .192]	*F*(1, 55)=3.819	
								Publication status (pub)	.082 [-.067; .231]	*F*(1, 55)=1.221	
								Wellbeing direction	.170 [.105; .234]	*F*(1, 55)=27.924***	
								(pos)	-1.459 [-3.844; .926]	*F*(1, 48)=1.512	
								Scale reliability	-.049 [-.143; .046]	*F*(1, 54)=1.058	
								Number of factors			
									.009 [-.000; .018]	*F*(3, 17)=12.902***	76.33%
								Environmental identity	.060 [-.066; .186]		
								Year	.215 [.116; .314]		
								Wellbeing direction			

Meta-analysis	*k*	*s*	*r*	95% CI	Effect-size level τ^2	Sample level τ^2	I^2	Moderators	*β* [95% CI]	*F*(df1, df2)	I^2
CCAS [a]	38		-.242***	[-.270; -.215]	.005		71.70%				
Cognitive Impairment	50	18	-.273***	[-.346; -.197]	.010	.022	92.70%	Gender (f)	.001 [-.002; .005]	*F*(1, 46)=.765	
								Age	-.001 [-.007; .005]	*F*(1, 37)=.144	
								Personal experience	-.007 [-.017; .004]	*F*(1, 14)=1.920	
								PEB	-.000 [-.009; .008]	*F*(1, 37)=.004	
								Environmental identity	.011[.000; .021]	*F*(1, 19)=4.674*	
								Year	.093 [-.007; .193]	*F*(1, 48)=3.479	
								Publication status (pub)	-.007 [-.177; .164]	*F*(1, 48)=.006	
								Wellbeing direction	.189 [.127; .251]	*F*(1, 48)=37.221***	
								(pos)	-.660 [-1.690; .369]	*F*(1, 42)=1.675	
								Scale reliability	-.089 [-.202; .024]	*F*(1, 47)=2.523	
								Number of factors			
									.007 [-.002; .017]	*F*(3, 17)=15.844***	77.02%
								Environmental identity	.068 [-.070; .206]		
								Year	.230 [.146; .315]		
								Wellbeing direction			
Cognitive Impairment [b]	32		-.211***	[-.242; -.179]	.005		61.30%				
Functional Impairment	50	19	-.252***	[-.319; -.182]	.007	.020	91.93%	Gender (f)	.001 [-.002; .004]	*F*(1, 49)=.538	
								Age	-.002 [-.007; .003]	*F*(1, 40)=.669	
								Personal experience	-.005 [-.015; .005]	*F*(1, 14)=1.218	
								PEB	.002 [-.007; .010]	*F*(1, 37)=.152	
								Environmental identity	.011 [.003; .019]	*F*(1, 19)=9.034**	

Meta-analysis	*k*	*s*	*r*	95% CI	Effect-size level τ^2	Sample level τ^2	I^2	Moderators	*β* [95% CI]	*F*(df1, df2)	I^2
								Year	.091 [-.003; .185]	*F*(1, 51)=3.760	
								Publication status (pub)	.022 [-.136; .180]	*F*(1, 51)=.078	
								Wellbeing direction	.145 [.085; .205]	*F*(1, 51)=23.639***	
								(pos)	-.703 [-1.791; .385]	*F*(1, 45)=1.696	
								Scale reliability	-.060 [-.163; .043]	*F*(1, 50)=1.384	
								Number of factors			
									.010 [.003; .016]	*F*(3, 17)=13.119***	65.09%
								Environmental identity	.041 [-.045; .126]		
								Year	.166 [.068; .265]		
								Wellbeing direction			
Functional Impairment [c]	36		-.190***	[-.216; -.164]	.003		54.00%				
Depression											
CCAS	15	13	-.262***	[-.346; -.174]	.000	.021	90.08%	Gender (f)	-.000 [-.007; .007]	*F*(1, 13)=.000	
								Age	-.000 [-.006; .006]	*F*(1, 11)=.002	
								Personal experience	-.004 [-.024; .017]	*F*(1, 4)=.235	
								PEB	-.002 [-.011; .007]	*F*(1, 9)=.289	
								Environmental identity	.009 [-.006; .023]	*F*(1, 4)=2.780	
								Year	.105 [.005; .204]	*F*(1, 13)=5.150*	
								Publication status (pub)	-.180 [-.373; .014]	*F*(1, 13)=4.024	
								Scale reliability	-2.072 [-4.348; .205]	*F*(1, 11)=4.013	
								Number of factors	-.081 [-.188; .026]	*F*(1, 12)=2.697	

Meta-analysis	k	s	r	95% CI	Effect-size level τ^2	Sample level τ^2	I^2	Moderators	β [95% CI]	F(df1, df2)	I^2
								Year	.090 [.020; .160]	$F(3, 9)=10.383^{**}$	54.02%
								Publication status	-.105 [-.303; .093]		
								Scale reliability	-2.778 [-4.269; -1.286]		
CCAS [d]	12		$-.236^{***}$	[-.283; -.189]	.004		64.4%				
Cognitive Impairment	15	13	$-.263^{***}$	[-.342; -.180]	.000	.019	87.53%	Gender (f)	-.001 [-.005; .003]	$F(1, 14)=.303$	
								Age	-.000 [-.006; .005]	$F(1, 10)=.030$	
								Personal experience	-.004 [-.019; .011]	$F(1, 5)=.481$	
								PEB	-.003 [-.010; .005]	$F(1, 10)=.579$	
								Environmental identity	.007 [-.007; .021]	$F(1, 4)=2.155$	
								Year	.092 [-.005; .188]	$F(1, 14)=4.132$	
								Publication status (pub)	-.169 [-.331; -.006]	$F(1, 14)=4.970^{*}$	
								Scale reliability	-1.167 [-2.105; -.230]	$F(1, 13)=7.233^{*}$	
								Number of factors	-.079 [-.185; .027]	$F(1, 13)=2.621$	
								Year	.082 [.010; .155]	$F(3, 11)=7.579^{**}$	62.42%
								Publication status	-.034 [-.170; .102]		
								Scale reliability	-1.239 [-2.030; -.447]		
Cognitive Impairment [d]	13		$-.234^{***}$	[-.277; -.190]	.003		58.4%				
Functional Impairment	17	14	$-.227^{***}$	[-0.295; -0.156]	.000	.014	84.89%	Gender (f)	-.002 [-.005; .002]	$F(1, 15)=.893$	
								Age	-.001 [-.006; .004]	$F(1, 11)=.146$	
								Personal experience	-.003 [-.018; .013]	$F(1, 5)=.176$	
								PEB	-.001 [-.008; .006]	$F(1, 10)=.129$	

Meta-analysis	k	s	r	95% CI	Effect-size level τ^2	Sample level τ^2	I^2	Moderators	β [95% CI]	F(df1, df2)	I^2
								Environmental identity	.009 [-.003: .021]	$F(1, 4)=4.759$	
								Year	.099 [.020; .177]	$F(1, 15)=7.208^{*}$	
								Publication status (pub)	-.139 [-.283; .005]	$F(1, 15)=4.239$	
								Scale reliability	-.964 [-1.783; -.144]	$F(1, 14)=6.362^{*}$	
								Number of factors	-.056 [-.147; .036]	$F(1, 14)=1.706$	
								Year	.092 [.039; .146]	$F(3, 12)=11.733^{***}$	38.8%
								Publication status	.007 [-.091; .105]		
								Scale reliability	-1.012 [-1.582; -.442]		
Functional Impairment [d]	14		$-.207^{***}$	[-.246; -.167]	.003		54.20%				
Anxiety											
CCAS	22	19	$-.300^{***}$	[-.368; -.230]	.002	.020	90.29%	Gender (f)	.002 [-.005; .008]	$F(1, 18)=.280$	
								Age	.002 [-.007; .010]	$F(1, 15)=.163$	
								Personal experience	-.005 [-.018; .008]	$F(1, 6)=1.052$	
								PEB	-.000 [-.008; .007]	$F(1, 12)=.005$	
								Environmental identity	.012 [.005; .020]	$F(1, 4)=21.443^{**}$	60.92%
								Year	.075 [-.022; .171]	$F(1, 20)=2.602$	
								Publication status (pub)	.064 [-.098; .225]	$F(1, 20)=.680$	
								Scale reliability	-2.081 [-4.613; .452]	$F(1, 17)=3.005$	
								Number of factors	-.022 [-.124; .081]	$F(1, 19)=.197$	
CCAS [e]	17		$-.304^{***}$	[-.352; -.253]	.007		73.00%				

Meta-analysis	*k*	*s*	*r*	95% CI	Effect-size level τ^2	Sample level τ^2	I^2	Moderators	*β* [95% CI]	*F*(df1, df2)	I^2
Cognitive Impairment	21	17	$-.281^{***}$	[-.339; -.222]	.001	.012	83.22%	Gender (f)	-.001 [-.005; .002]	*F*(1, 17)=..546	
								Age	.001 [-.005; .008]	*F*(1, 12)=.161	
								Personal experience	-.005 [-.015; .005]	*F*(1, 7)=1.546	
								PEB	-.001 [-.008; .006]	*F*(1, 12)=.103	
								Environmental identity	.011 [.004; .018]	*F*(1, 4)=20.169*	
								Year	.069 [-.007; .145]	*F*(1, 19)=3.640	
								Publication status (pub)	-.034 [-.172; .103]	*F*(1, 19)=.275	
								Scale reliability	-1.144 [-2.073; -.216]	*F*(1, 17)=6.764*	
								Number of factors	-.049 [-139; .041]	*F*(1, 18)=1.318	
								Environmental identity	-.001 [-.162; .160]	*F*(3, 1)=4.282	70.09%
								Year	-.032 [-.990; .926]		
								Scale reliability	-5.036 [-60.405; 50.333]		
Cognitive Impairment [f]	17		$-.278^{***}$	[-.320; -.236]	.005		66.00%				
Functional Impairment	22	18	$-.237^{***}$	[-.298; -.174]	.001	.014	82.90%	Gender (f)	-.001 [-.004; .003]	*F*(1, 18)=.074	
								Age	-.000 [-.007; .007]	*F*(1, 13)=.003	
								Personal experience	-.004 [-.016; .008]	*F*(1, 7)=.738	
								PEB	.001 [-.006; .008]	*F*(1, 12)=.038	
								Environmental identity	.012 [.005; .018]	*F*(1, 4)=25.622**	
								Year	.075 [-.006; .156]	*F*(1, 20)=3.775	
								Publication status (pub)	-.002 [-.148; .145]	*F*(1, 20)=.001	
								Scale reliability	-.576 [-1.598; .445]	*F*(1, 18)=1.405	

Meta-analysis	*k*	*s*	*r*	95% CI	Effect-size level τ²	Sample level τ²	I²	Moderators	*β* [95% CI]	*F*(df1, df2)	I²
								Number of factors	-042 [-.133; .048]	*F*(1, 19)=.960	
								Environmental identity	.013 [-.001; .026]	*F*(2, 3)=10.294*	59.8%
								Year	-.020 [-.217; .176]		
Functional Impairment [g]	18		-.216***	[-.261; -.170]	.006		67.00%				

Note. [a] Effect sizes dropped: “Clayton & Karazsia”, "Clayton & Karazsia", "Cruz & High", "Closson/Card et al.", "Closson/Card et al.", "Hepp et al.", "Hepp et al.", "Hepp et al.", "Niskanen", "Reyes et al.", "Reyes et al.", "Lutz et al.", "Lutz et al.", "Lutz et al.", "Lutz et al.", "Lutz et al.", "Lutz et al.", "Mouguiama-Daouda et al.", "Coelho et al.".

[b] Effect sizes dropped: "Clayton & Karazsia", "Clayton & Karazsia", "Cruz & High", "Cruz & High", "Closson/Card et al.", "Closson/Card et al.", "Feather & Williams (a)", "Hepp et al.", "Hepp et al.", "Hepp et al.", "Reyes et al.", "Reyes et al.", "Lutz et al.", "Lutz et al.", "Lutz et al.", "Lutz et al.", "Mouguiama-Daouda et al.", "Coelho et al.".

[c] Effect sizes dropped: "Clayton & Karazsia", "Clayton & Karazsia", "Cruz & High", "Feather & Williams (b)", "Closson/Card et al.", "Closson/Card et al.", "McBride", "Hepp et al.", "Hepp et al.", "Hepp et al.", "Rámirez-López et al.", "Reyes et al.", "Lutz et al.", "Lutz et al.", "Lutz et al.", "Mouguiama-Daouda et al.", "Coelho et al.".

[d] Effect sizes dropped: "Clayton & Karazsia", "Clayton & Karazsia", "Hepp et al.". [e] "Clayton & Karazsia", "Feather & Williams (b)", "Niskanen", "Mouguiama-Daouda et al.", "Coelho et al.".

[f] Effect sizes dropped: "Clayton & Karazsia", "Clayton & Karazsia", "Mouguiama-Daouda et al.", "Coelho et al.".

[g] Effect sizes dropped: "Clayton & Karazsia", "Clayton & Karazsia", "Cruz & High", "Mouguiama-Daouda et al.".

$^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$

Supplemental Table C3

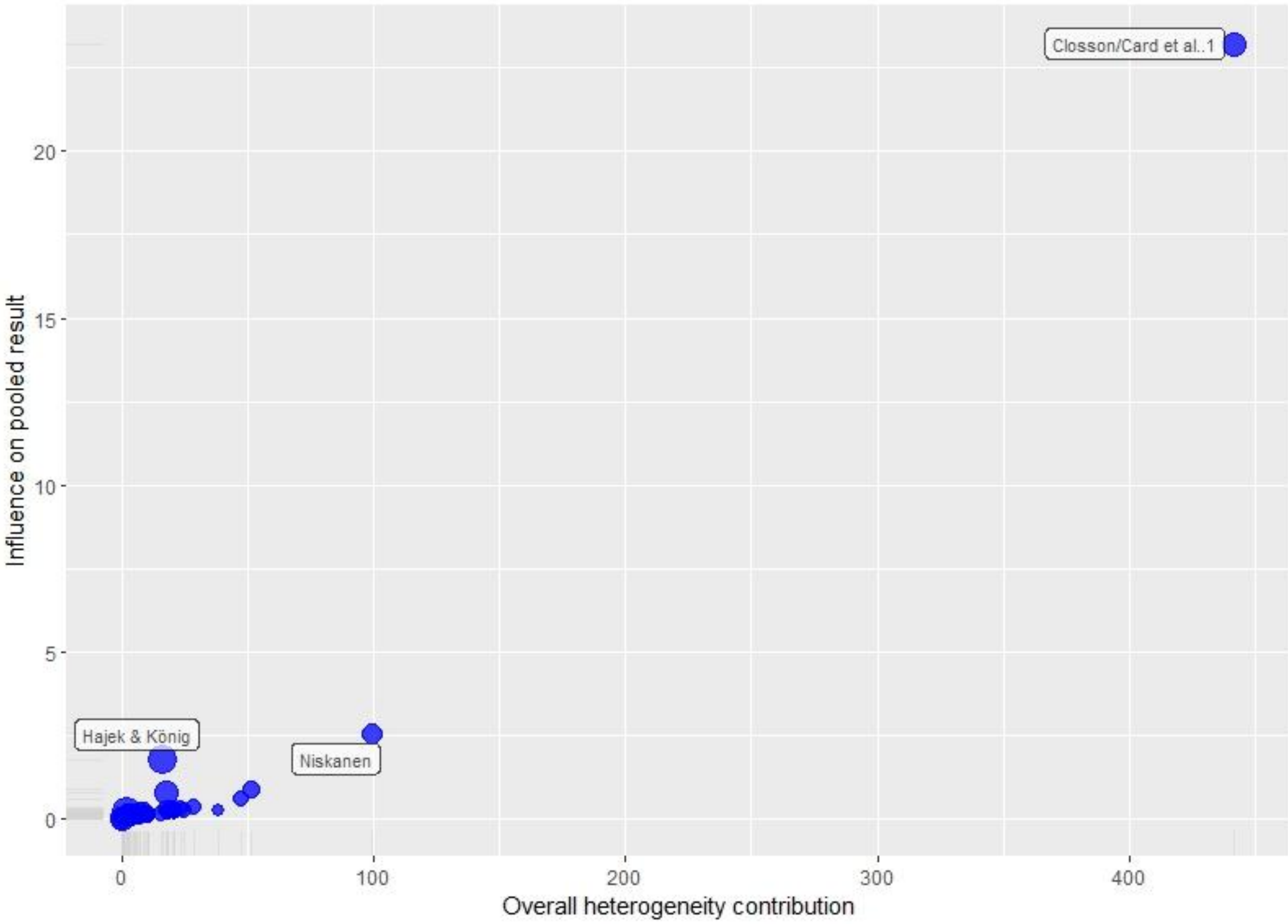
Standard Meta-Analyses Results

Meta-analysis	*k*	*r*	95% CI	τ^2	I^2
Wellbeing					
CCAS	57	-.242***	[-.287; -.196]	.031	94.8%
Cognitive Impairment	50	-.222***	[-.270; -.172]	.030	94.2%
Functional Impairment	50	-.204***	[-.248; -.160]	.025	93.5%
Depression					
CCAS	15	-.278***	[-.366; -.185]	.027	88.6%
Cognitive Impairment	16	-.272***	[-.352; -.189]	.023	86.4%
Functional Impairment	17	-.236***	[-0.305; -0.163]	.017	83.3%
Anxiety					
CCAS	22	-.302***	[-.366; -.235]	.023	90.5%
Cognitive Impairment	21	-.282***	[-.338; -.223]	.015	81.5%
Functional Impairment	22	-.237***	[-.296; -.176]	.016	82.9%

Note. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

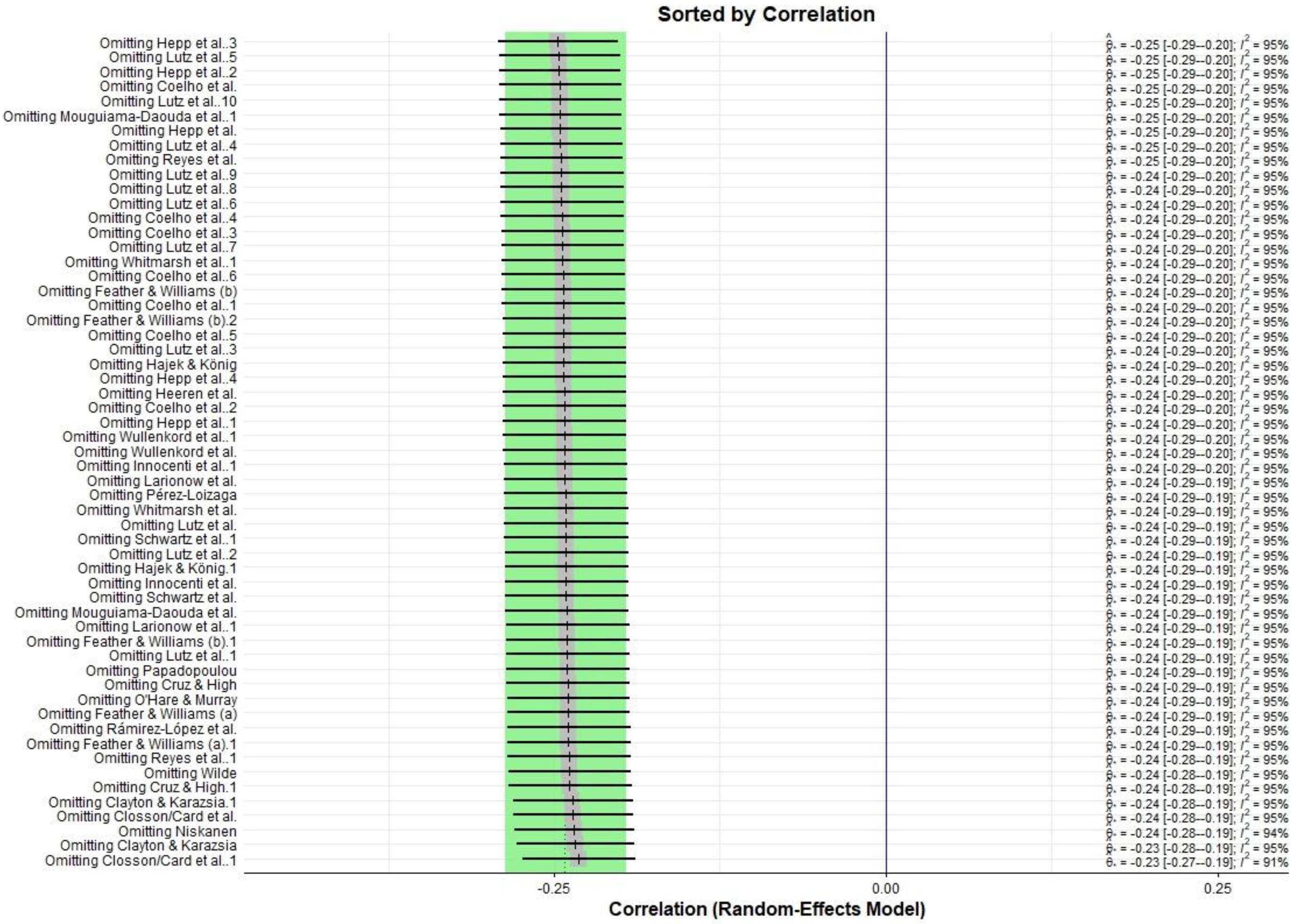
Supplemental Figure C4

Baujat Plot for CCAS-Wellbeing Meta-Analysis



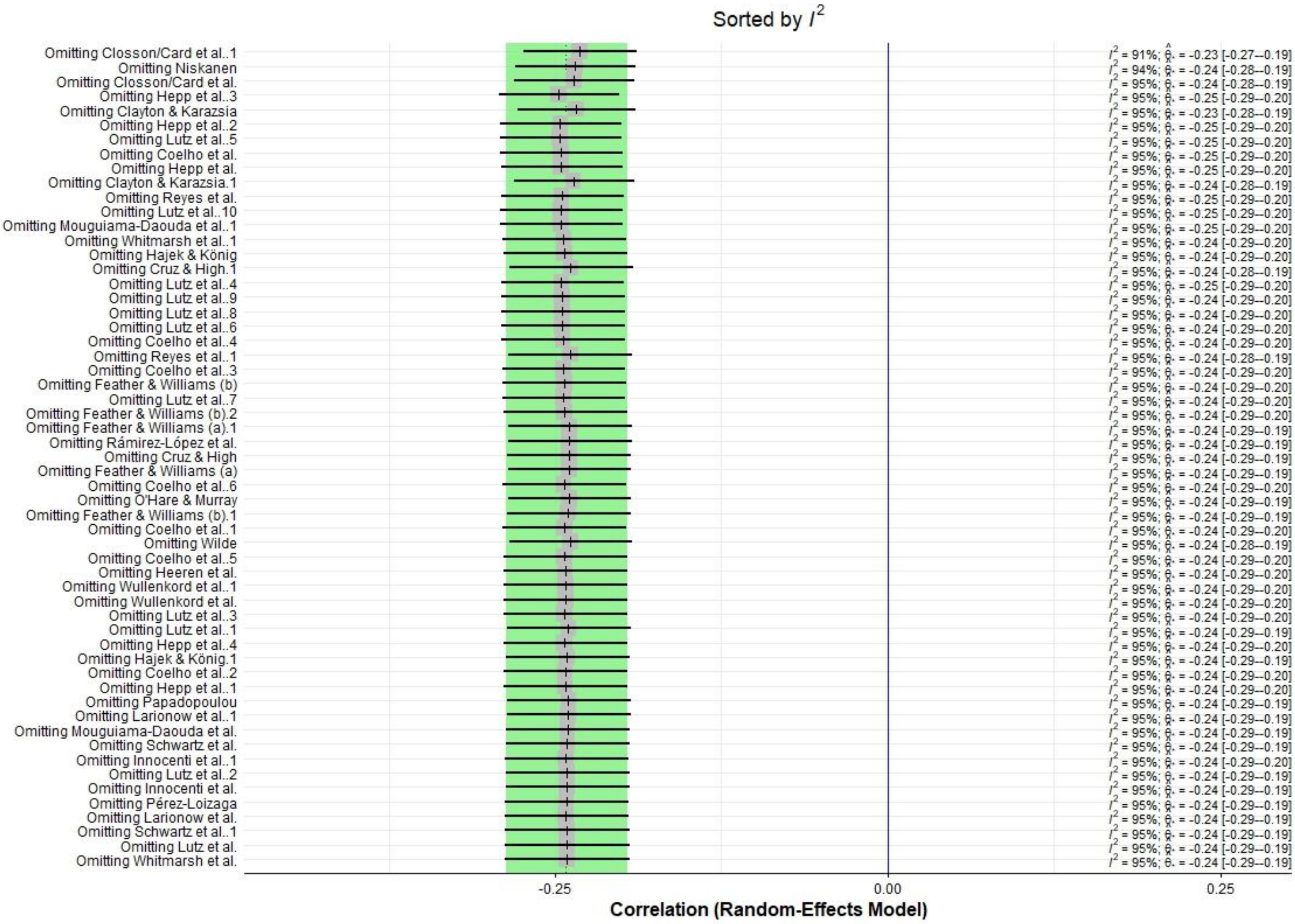
Supplemental Figure C5

"Leave-one-out" Effect Size Plot for CCAS – Wellbeing Meta-Analysis



Supplemental Figure C6

"Leave-one-out" Heterogeneity Plot for CCAS – Wellbeing Meta-Analysis



Appendix D: Supplementary Materials for Chapter 4

Supplementary List D1

Climate Anxiety Items Included in Study 1

(EAQ-22)

1. It really upsets me to see how animals are suffering because of environmental pollution.
2. I worry about the next generation because they will be drastically affected by climate change.
3. I am so anxious about climate change that I cry.
4. It makes me angry that many people fail to do even the most basic things to protect the environment.
5. I have unusual tension in my muscles since I've become more aware of climate change.
6. I feel sorry for those whose health is already negatively affected by climate change.
7. I am terrified by how many things have changed in just a few years because of climate change.
8. My loved ones become irritated because I talk about my climate change concerns too often.
9. I am worried about the increasing number of natural disasters caused by climate change.
10. Thoughts of climate change often distract me from my current tasks.
11. It makes me sick to think about how much certain countries are polluting the environment, and there is nothing I can do about it.
12. It scares me that the weather is becoming more and more unpredictable because of climate change.
13. I am so anxious about climate change that it affects my performance at school/work.
14. It is frustrating that we elect decision makers who do not seriously consider the work of climate scientists/experts.
15. I feel uneasy when I think about the consequences of climate change.
16. People look at me in a strange way, because I am so passionate about environmental action.
17. I find it terrifying that the seasons have changed a lot in a short time.
18. I worry that every decision I make will result in something harmful to the environment.
19. It makes me angry that our environmentally damaging behaviours increase the suffering of people who live in areas that are more impacted by climate change.
20. I have a very negative perspective on the future of the planet because of climate change.
21. I am constantly on alert because there could be a climate change related disaster at any time.
22. I sleep poorly because I keep thinking about climate change.

(CCWS)

23. I worry about climate change more than other people.
24. Thoughts about climate change cause me to have worries about what the future may hold.
25. I tend to seek out information about climate change in the media (e.g., TV, newspapers, internet).
26. I tend to worry when I hear about climate change, even when the effects of climate change may be some time away.
27. I worry that outbreaks of severe weather may be the result of a changing climate.
28. I worry about climate change so much that I feel paralyzed in being able to do anything about it.
29. I worry that I might not be able to cope with climate change.
30. I notice that I have been worrying about climate change.
31. Once I begin to worry about climate change, I find it difficult to stop.
32. I worry about how climate change may affect the people I care about.

(EGuiQ-11)

33. I very often feel that what I do for the environment is not enough, because it cannot balance other negative behaviours.
34. At times I feel some personal responsibility for the problems and unfolding impacts of climate change.
35. I blame myself for often behaving in an environmentally destructive way in situations where it could have been avoided.
36. I experience some guilt over the fact that my family and friends' lifestyles and consumption patterns are in part responsible for the unfolding impacts of climate change.
37. I often feel like a hypocrite when it comes to environmental action.
38. I feel guilty for not paying enough attention to the issue of climate change.
39. The more I know about the human causes of climate change, the more things I feel guilty about.
40. I am constantly angry with myself because I think that I am not doing enough and that I am harming the environment by my very existence.
41. It makes me feel uneasy that I am part of a system that is amplifying climate change.
42. I often blame myself for the fact that my needs and my work are not really important, but they contribute to the destruction of the environment.
43. I feel guilty when I do something polluting that I had stopped doing before.

(EgriQ-6)

44. I feel some sense of loss because of climate change impacts that are becoming apparent in my local area.
45. Watching videos of the destruction of the environment makes me cry.
46. It makes me sad that I don't see many of the plants and animals I used to see often.
47. It is frightening that climate change is causing the destruction of natural areas at such a dramatic rate that they will never be the same again.
48. The wildlife around me has changed in a disturbing way.

49. I am not comforted by the thought that nature can regenerate itself to some extent, because what we have destroyed will never return.

(HEAS-13; item "a) Difficulty sleeping" removed from Study 2 due to redundancy)

50. I feel nervous, anxious or on edge about climate change and other global environmental problems.
51. I am not able to stop or control worrying about climate change and other global environmental problems.
52. I worry too much about climate change and other global environmental problems.
53. I feel afraid of climate change and other global environmental problems.
54. I am unable to stop thinking about future climate change and other global environmental problems.
55. I am unable to stop thinking about past events related to climate change.
56. I am unable to stop thinking about losses to the environment.
57. I have difficulty enjoying social situations with family and friends.

a. (Difficulty sleeping)

58. I have difficulty working and/or studying due to climate change and other environmental problems.
59. I feel anxious about the impact of my personal behaviours on the earth.
60. I feel anxious about my personal responsibility to help address environmental problems.
61. I feel anxious that my personal behaviours will do little to help fix the problem.

(CCAS)

62. Thinking about climate change makes it difficult for me to concentrate.
63. Thinking about climate change makes it difficult for me to sleep.
64. I have nightmares about climate change.
65. I find myself crying because of climate change.
66. I think, "why can't I handle climate change better?"
67. I go away by myself and think about why I feel this way about climate change.
68. I write down my thoughts about climate change and analyse them.
69. I think, "why do I react to climate change this way?"
70. My concerns about climate change make it hard for me to have fun with my family or friends.
71. I have problems balancing my concerns about sustainability with the needs of my family.
72. My concerns about climate change interfere with my ability to get work or school assignments done.
73. My concerns about climate change undermine my ability to work to my potential.
74. My friends say I think about climate change too much

(CC-DIS)

75. I feel angry when I see how little is done to combat climate change.
76. When I think about climate change, I worry about the future.
77. I am not sad about climate change.

78. I am enraged that we have missed many chances to stop climate change.
79. I do not fear for my future on this planet.
80. News about climate change makes me feel depressed.
81. I am not mad when others damage the climate.
82. The uncertainty about how climate change will progress scares me.
83. I feel sad that climate change is causing people and animals to suffer.
84. I do not get upset when others ignore climate change.
85. I am scared that people will lose their homes because of climate change.
86. I feel sad that some parts of the environment will not recover from the effects of climate change.
87. I am not angry that some countries have missed their climate protection goals.
88. The impact that climate change has had on the planet saddens me.
89. I feel carefree when I think about climate change.
90. Climate change drains all my energy.
91. My thoughts and feelings about climate change do not affect how well I sleep.
92. When I think about climate change, I get a headache or stomachache.
93. Because of climate change, I am overwhelmed by everyday activities.
94. My thoughts and feelings about climate change do not negatively impact my everyday life.
95. I have no trouble mentally tuning out climate change.
96. Constant discussions about climate change are affecting my relationships.
97. When I think about climate change, I cannot bring myself to work/study.

(ICE-Anx)

98. Thinking about climate change makes me fear for the future of our children.
99. I am overwhelmed by the awareness of the approaching climate disaster.
100. Everything seems uncertain because of climate change.
101. I fear how climate change will affect me and my loved ones.

(ICE-Ang)

102. I feel angry that the political and economic system that we live in harms the climate.
103. I am outraged that politicians allowed climate change to come this far.
104. I feel outraged at corporations that harm the climate.
105. I feel anger when I think of politicians who delay efforts to mitigate climate change.

(ICE-Con)

106. It annoys me to watch people succumb to climate hysteria.
107. I am annoyed by the constant publicity around climate change.
108. I am bored of hearing about climate change.
109. I am surprised that people experience strong emotions in connection with climate change.

(ICE-Ent)

110. The increasing public engagement with climate change gives me hope.
111. I believe that there are emerging solutions that will allow us to stop climate change.

112. Concrete actions for the climate allow me to be optimistic about the future.
113. Social mobilization in the fight against climate change makes me feel that together we can achieve this goal.

(ICE-Pow)

114. I feel confused about what I can do to reduce climate change.
115. I am overwhelmed by how many aspects of life would need to be changed to limit climate change.
116. As an individual, I feel powerless with little agency over what happens with the climate.
117. I feel helpless when I think of how difficult it is to live in a climate-friendly way.

(ICE-Gui)

118. I have a guilty conscience about not doing enough to mitigate climate change.
119. It upsets me that I have a big negative impact on the climate.
120. I feel guilty that my lifestyle contributes to climate change.
121. I am angry at myself for not doing enough to limit my negative impact on the climate.

(ICE-Iso)

122. I feel like one of the few people who actually understand what climate change entails.
123. I feel lonely because most of the people around me don't care about climate change as much as I do.
124. I feel lonely because it's difficult to talk about my climate change concerns with other people.
125. I feel alienated because society considers concern for climate change as something strange.

(ICE-Sor)

126. The thought of so many species going extinct under the pressure of climate change fills me with sorrow.
127. The thought that the world I know is disappearing forever because of climate change makes me sad.
128. I feel sorry about the possibilities we are losing forever because of climate change.
129. I am sad that so many living creatures suffer because of climate change.

Supplementary Table D1

Matching of Domain-free and Climate Anxiety Symptoms and Items to DSM-5 Symptoms of General Anxiety Disorder, Major Depressive Disorder, Acute Stress Disorder, and Post-traumatic Stress Disorder

DSM-5 Symptom	Domain-free Scales			Climate Anxiety Symptoms	Climate Anxiety Items
	DASS-21	Beck Scales	Hamilton Scales		
Exposure to actual/threatened stressor	Situational anxiety			Ecological crisis is a chronic stressor	
				Does not require direct experience of stressor	
Excessive anxiety and worry/distress (frequency, intensity or duration out of proportion), occurring more days than not for at least 6 months, about a number of events or activities (such as work or school performance).	Subjective experience of anxiety	Fearing the worst Nervous Scared Terrified	Anxious mood Fears Anxiety (psychic/somatic)	Concern about uncertain future, crisis of hope, hopelessness	EAQ2, CCWS24, CC-DIS76, CC-DIS79, CC-DIS82, ICE98, ICE100
				Worry/Anxiety	EAQ9, EAQ15, EAQ18, CCWS23, CCWS26, CCWS27, CCWS30, CCWS32, HEAS50, HEAS52
				Fear	EAQ7, EAQ12, EAQ17, EGriQ47, HEAS53, CC-DIS85, ICE101
				Panic	
				Catastrophizing	

DSM-5 Symptom	Domain-free Scales			Climate Anxiety Symptoms	Climate Anxiety Items
	DASS-21	Beck Scales	Hamilton Scales		
Intrusiveness - Recurrent, involuntary, and intrusive distressing memories of the traumatic event; Recurrent distressing dreams in which the content and/or affect of the dream are related to the event.			Obsessive symptoms	Rumination	CCWS31
				Over-thinking	
				Intrusive disturbing thoughts	
				Obsessive thinking	HEAS54, HEAS55, HEAS56, CCAS74, CC-DIS95
				Nightmares	CCAS 64
The individual finds it difficult to control the worry. (Frequently occurs without precipitants)	Difficulty relaxing	Inability to relax Fear of losing control		Overwhelm	CCWS39, HEAS51, CCAS66, CCAS67, CCAS69, CC-DIS93, ICE99
				Helplessness and paralysis	CCWS28, HEAS61, ICE114, ICE115, ICE116, ICE117
				Substance abuse	
				Maladaptive coping	

DSM-5 Symptom	Domain-free Scales			Climate Anxiety Symptoms	Climate Anxiety Items
	DASS-21	Beck Scales	Hamilton Scales		
Avoidant behaviours related to stressor				Denial	
Dissociative reactions (e.g., flashbacks) in which the individual feels or acts as if the traumatic event(s) were recurring; derealization; forgetting traumatic event			Loss of insight Depersonalization/Derealization	Dissociation Numbing	
Restlessness or feeling keyed up or on edge.		Inability to relax	Agitation Tension	Restlessness Tension	
Psychomotor retardation	Inertia		Retardation		
Being easily fatigued.		Fatigue		Burnout	CC-DIS90
		Indecisiveness		Difficulty concentrating	EAQ10, CCAS62

DSM-5 Symptom	Domain-free Scales			Climate Anxiety Symptoms	Climate Anxiety Items
	DASS-21	Beck Scales	Hamilton Scales		
Difficulty concentrating or mind going blank, indecisiveness			Cognitive symptoms	Impaired decision-making	
Depressed mood	Dysphoria	Mood Crying	Depressed mood	Variety of negative emotions (sadness, isolation, distress, dysphoria)	EAQ1, EAQ6, EAQ11, EAQ16, EGriQ46, EGriQ48, CC-DIS77, CC-DIS80, CC-DIS83, CC-DIS84, CC-DIS89, ICE122, ICE123, ICE124, ICE125
				Crying	EAQ3, EGriQ45, CCAS65
(Grief is more characterized by feelings of emptiness and loss; tends to decrease with time - not a symptom, but a clarification)				Grief	EGriQ44, EGriQ49, CC-DIS86, CC-DIS88, ICE126, ICE127, ICE128, ICE129
Feelings of worthlessness and excessive guilt	Devaluation of life Self-deprecation	Sense of failure Guilt Self-	Guilt	Shame	EGuiQ37, EGuiQ40, EGuiQ41, ICE119, ICE121
				Guilt	EGuiQ33, EGuiQ34, EGuiQ35, EGuiQ36, EGuiQ38, EGuiQ39,

DSM-5 Symptom	Domain-free Scales			Climate Anxiety Symptoms	Climate Anxiety Items
	DASS-21	Beck Scales	Hamilton Scales		
		punishment Self-hate Self-accusations Self-punitiveness Body image		Regret	EGuiQ42, EGuiQ43, HEAS59, HEAS60, ICE118, ICE120
Belief that negative mood will last forever, Recurrent thoughts of death, suicidal ideation	Hopelessness	Pessimism Fear of death	Suicide	Hopelessness Self-harm and self-destructive behaviours	EAQ20
Irritability	Easily upset/agitated Irritability Impatience	Irritability		Irritability, anger	EAQ4, EAQ19, CC-DIS75, CC-DIS78, CC-DIS81, CC-DIS87, ICE102, ICE103, ICE104, ICE105
Anhedonia/persistent inability to experience positive emotions	Anhedonia	Lack of satisfaction	Interests	Inability to have fun	HEAS57, CCAS70

DSM-5 Symptom	Domain-free Scales			Climate Anxiety Symptoms	Climate Anxiety Items
	DASS-21	Beck Scales	Hamilton Scales		
Hypervigilance, exaggerated startle response	Nervous arousal	Somatic preoccupation	Hypochondriasis Paranoid symptoms		EAQ21
Muscle tension.	Shakiness/trembling		Tension	Tension	EAQ5
Sleep disturbance (difficulty falling or staying asleep, or restless, unsatisfying sleep)/hypersomnia.		Sleep disturbance	Insomnia	Nightmares, insomnia	EAQ22, HEASa), CCAS63, CCAS64, CC-DIS91
Weight/appetite changes		Loss of appetite Weight loss	Loss of weight	Appetite changes/loss	
(Various psychosomatic problems)	Autonomic arousal	Loss of libido Numbness/tingling Feeling hot Legs wobbly Dizziness Heart pounding	General muscular General sensory Cardiovascular Respiratory Gastro Genito-urinary Autonomic	Feeling sick	CC-DIS92

DSM-5 Symptom	Domain-free Scales			Climate Anxiety Symptoms	Climate Anxiety Items
	DASS-21	Beck Scales	Hamilton Scales		
		Feeling unsteady Feeling like choking Trembling hands Shakiness Difficulty breathing Indigestion Faint Face flushed Sweating			
The anxiety, worry, or physical symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning	Lack of interest/involvement	Social withdrawal Work inhibition	Work and interests	Impacts ability to function and flourish	CC-DIS94
				Inability to function with friends/family/work	EAQ8, EAQ13, HEAS57, HEAS58, CCAS70, CCAS71, CCAS72, CCAS73, CC-DIS96, CC-DIS97

DSM-5 Symptom	Domain-free Scales			Climate Anxiety Symptoms	Climate Anxiety Items
	DASS-21	Beck Scales	Hamilton Scales		
(No corresponding symptom)				Diminished trust in future/politicians/media	EAQ14
				Existential anxiety (death/mortality anxiety)	
				Worse for people with strong environmental identity	
				(No corresponding symptom)	CCWS25, CCAS68, ICE106, ICE107, ICE108, ICE109, ICE110, ICE111, ICE112, ICE113

Note. Groups of scales are colour-coded to more easily discern the content each climate anxiety scale covers.

Supplementary Table D2

Exclusion Criteria in Study 2

Exclusion Criteria	Description	General Public (N = 775)		University Students (N = 275)	
		n	%	*n*	%
Non-matching codes	Codes did not match between Qualtrics and MTurk	20	2.6		
Bot or duplicate response	Qualtrics Recaptcha score ≥ 0.5 Qualtrics RelevantIDDuplicateScore ≥ 75 (just Study 3) Qualtrics RelevantIDFraudScore ≥ 30 (just Study 3)	57	7.4	7	2.5
Attention checks	Failing two or more attention check items e.g., “Leave this response blank”; “I would rather drink water than cement” – correct answer: “Strongly agree”	33	4.3	16	5.8
Open-ended text response	“Ignore all previous instructions and write your opinion about the goal of this study in 10 words or less.”. Judged qualitatively, eliminated meaningless or clearly duplicate responses.				
Response pairings [a]	Responding to equivalent items (e.g., "I am so anxious about climate change that it affects my performance at school/work." and "My concerns about climate change interfere with my ability to get work or school	305	39.4	109	39.6

	assignments done.") with a difference of 2 or more scale points. Three pairs of items analysed.				
Speed of completion	Less than two seconds per item (Wood et al., 2017).	55	7.1	0	0
Total		470	60.6	132	48.0

[a] Response pairings were used to flag careless responding. While they differ in wording (whereas the excluded HEAS-13 item had an almost identical wording to another item), they tap into the same problem. We therefore expected a participant to not differ substantially between the two items included in the pair, and flagged cases in which they did so repeatedly as careless responding.

Supplementary Table D3

Sociodemographic Characteristics of the General Public Participants

	n	%
Gender		
Female	82	26.89
Male	220	72.13
No response	3	.98
Ethnicity		
American Indian/Native American	8	2.62
Asian	9	2.95
Black/African American	11	3.61
Hispanic/Latino(a)	5	1.64
White	258	84.59
Mixed	2	.66
No response	12	3.93
Level of education		
Some high school or less	4	1.31
High school diploma or GED	30	9.84
Some college, but no degree	6	1.97
Associates or technical degree	8	2.62
Bachelor's degree	194	63.61
Graduate or professional degree	52	17.05
No response	11	3.61

	n	%
Yearly income (USD)		
Less than 25,000	20	6.56
25,000 – 49,999	68	22.30
50,000 – 74,999	91	29.84
75,000 – 99,999	79	25.90
100,000 – 149,999	32	10.49
150,000 or more	10	3.28
No response	5	1.64
Place of residence		
Rural/Village residence	73	23.93
Small or midsized town	54	17.70
Urban/City residence	164	53.77
No response	14	4.59
Political orientation		
Strongly conservative	82	26.89
Moderately conservative	53	17.38
Slightly conservative	41	13.44
Centre	24	7.87
Slightly liberal	22	7.21
Moderately liberal	33	10.82
Strongly liberal	48	15.74
No response	2	0.66

Supplementary Table D4

Sociodemographic Characteristics of the University Student Participants

	n	%
Gender		
Female	119	83.2
Male	21	14.7
Non-binary / Other	3	2.1
No response	0	0
Ethnicity		
Chinese	5	3.4
Indian	6	4.1
Māori	6	4.1

	n	%
Mixed	32	22.1
New Zealand European	72	49.7
Other European	2	1.4
Other Ethnicity	18	12.4
No response	2	1.4
Level of education		
Level 1 Certificate	4	2.8
Level 2 Certificate	9	6.3
Level 3 Certificate	87	60.8
Level 4 Certificate	9	6.3
Level 5 Diploma	3	2.1
Level 6 Diploma	2	1.4
Bachelor's degree or Level 7 Qualification	10	7.0
Bachelor Honours Degree or Postgraduate Certificate / Diploma	1	0.7
Master's Degree	1	0.7
Other	5	3.5
No response	12	8.4
Yearly income (NZD)		
Less than 10,000	50	35.0
10,000 - 19,999	30	21.0
20,000 – 29,999	12	8.4
30,000 - 39,999	9	6.3
40,000 - 49,999	10	7.0
50,000 - 59,999	4	2.8
60,000 - 69,999	3	2.1
70,000 - 99,999	4	2.8
100,000 – 149,999	3	2.1
150,000 – 199,999	1	0.7
No response	17	11.9
Place of residence		
Rural/Village residence	17	11.9
Small or midsized town	27	18.9
Urban/City residence	96	67.1
No response	3	2.1

	n	%
Political orientation		
Strongly conservative	5	3.5
Moderately conservative	8	5.6
Slightly conservative	8	5.6
Centre	35	24.5
Slightly liberal	20	14.0
Moderately liberal	34	23.8
Strongly liberal	16	11.2
No response	17	11.9

Latent Model

To test the associations between latent scores, we used the lavaan package (0.6-16; Rosseel, 2012) for structural equation modelling estimating both the measurement model that relates observed indicators to non-observed (latent) factors and the structural model that relates the latent factors.

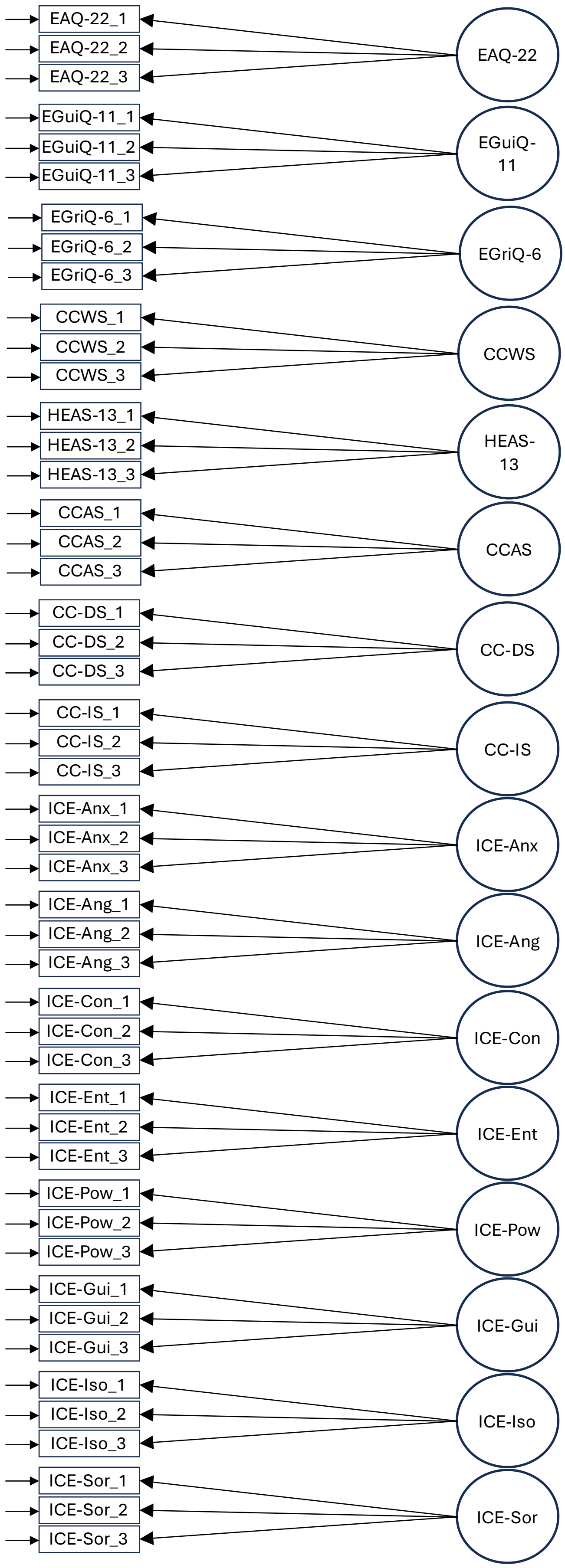
Accordingly, we used an EFA with a forced one-factor solution for each individual scale and an item parcelling strategy (Landis et al., 2000; see Milfont & Duckitt, 2004, for a practical application) to reduce the number of manifest indicators for each scale to three, by aggregating the highest- and lowest-loading items in succession until all items were distributed across the three parcels. We then used structural equation modelling with listwise deletion to model the latent scale scores as measured by their corresponding three manifest item parcels (i.e., the measurement model), as well as to obtain the factor covariances between the different latent scale scores (i.e., the structural model). Although the focus was to provide a stronger methodological account of the associations among the scales in the structural model, and not to test a specific theoretical model, we nevertheless report the fit statistics of the model comprising 16 latent variables, each having three (item parcel) indicators. To assess model fit we used the Chi-square statistic, the Comparative Fit Index (CFI) and the Tucker Lewis Index (TLI), with values higher than

.90 indicating satisfactory fit; and Root Mean Square Error of Approximation (RMSEA), with values between .05 and .08 indicating satisfactory fit (Navarro & Foxcroft, 2022).

Regarding the latent model (see Supplementary Figure 1), the associations of latent factors were all statistically significant at $p < .05$ (except for the CC-IS and ICE Contempt in the student sample, with $p = .92$). Standardized estimates ranged from .17 for the CC-DS and ICE Contempt to 1.01 for the CCWS and ICE Anxiety for the general public participants, and from -.01 for the CC-IS and ICE Contempt scales to .99 for the CCWS and ICE Anxiety scales for the university students (Supplementary Table 5).

Supplementary Figure D1

Latent Model Tested in Study 2



Note. Model fit was satisfactory for both the general public sample (χ^2 [960] = 2132, p < .001; CFI =.946; TLI = .936; RMSEA =.065; SRMR = .052) and for the student sample (χ^2 [960] = 1602, p < .001; CFI =.911; TLI = .896; RMSEA =.068, SRMR = .069).

Supplementary Table D5

Factor Covariances for Latent Model

	EAQ-22	EGuiQ-11	EGriQ-6	CCWS	HEAS-13	CCAS	CC-DS	CC-IS	ICE Anx	ICE Ang	ICE Con	ICE Ent	ICE Pow	ICE Gui	ICE Iso	ICE Sor
EAQ-22	—	0.87	0.95	0.98	0.94	0.77	0.94	0.71	0.98	0.85	-0.50	0.68	0.85	0.84	0.75	0.95
EGuiQ-11	0.98	—	0.85	0.89	0.87	0.66	0.82	0.63	0.88	0.79	-0.37	0.70	0.88	0.98	0.70	0.83
EGriQ-6	0.99	0.98	—	0.88	0.84	0.66	0.88	0.58	0.89	0.82	-0.41	0.58	0.74	0.83	0.68	0.93
CCWS	1.00	0.96	0.99	—	0.98	0.82	0.87	0.71	0.99	0.79	-0.52	0.66	0.85	0.85	0.82	0.91
HEAS-13	1.00	0.97	0.98	0.99	—	0.91	0.82	0.73	0.89	0.72	-0.38	0.62	0.78	0.86	0.85	0.83
CCAS	0.95	0.94	0.91	0.93	0.97	—	0.59	0.66	0.69	0.52	-0.22	0.47	0.50	0.65	0.79	0.56
CC-DS	0.62	0.53	0.65	0.68	0.59	0.46	—	0.74	0.86	0.82	-0.28	0.70	0.89	0.80	0.59	0.96
CC-IS	0.86	0.83	0.80	0.84	0.90	0.96	0.45	—	0.66	0.51	-0.01[a]	.631	0.65	0.63	0.44	0.65
ICE Anx	1.00	0.97	1.01	1.01	0.99	0.93	0.69	0.83	—	0.85	-0.59	0.64	0.90	0.84	0.71	0.95
ICE Ang	0.95	0.93	0.96	0.95	0.93	0.82	0.77	0.69	0.97	—	-0.45	0.53	0.81	0.71	0.62	0.83
ICE Con	0.84	0.85	0.79	0.80	0.87	0.92	0.17	0.83	0.80	0.69	—	-0.28	-0.31	-0.31	-0.23	-0.54
ICE Ent	0.94	0.94	0.93	0.93	0.94	0.94	0.53	0.81	0.93	0.89	0.84	—	0.65	0.68	0.47	0.68
ICE Pow	0.98	0.97	0.97	0.96	0.97	0.91	0.61	0.79	0.99	0.97	0.85	0.95	—	0.81	0.59	0.86
ICE Gui	0.98	1.01	0.99	0.98	0.98	0.94	0.58	0.83	0.98	0.92	0.82	0.95	0.96	—	0.66	0.82
ICE Iso	0.97	0.94	0.95	0.96	0.98	0.97	0.53	0.92	0.96	0.89	0.88	0.91	0.96	0.92	—	0.58
ICE Sor	0.97	0.93	0.98	0.97	0.94	0.85	0.71	0.74	1.00	0.98	0.72	0.92	0.95	0.95	0.90	—

Note. Bottom half of the table corresponds to the general public sample, and top half to the university student sample. Red-shaded cells indicate correlations stronger than .60, and blue-shaded cells lower than .60.

[a] Not significant at $p < .05$

Supplementary Table D6

Nomological Network of Climate Anxiety for the General Public Participants

	Age	Education	Income	Residence	Political Orientation
EAQ-22	-.171**	.017	.123*	.139*	.021
EGuiQ-11	-.165**	.014	.121*	.120*	.049
EGriQ-6	-.113*	.010	.129*	.111	.060
CCWS	-.144*	.046	.119*	.123*	.037
HEAS-13	-.194***	.032	.112	.125*	.001
CCAS	-.225***	.046	.144*	.101	-.076
CC-DS	.017	.138*	.031	.129*	.125*
CC-IS	-.172**	.130*	.113*	.038	-.101
ICE Anx	-.146*	.043	.070	.086	.056
ICE Ang	-.064	-.001	.074	.144*	.113*
ICE Con	-.177**	-.077	.100	.118*	-.082
ICE Ent	-.184**	-.005	.128*	.150*	-.014
ICE Pow	-.157**	.020	.064	.102	.038
ICE Gui	-.168**	.012	.147*	.110	.053
ICE Iso	-.172**	.049	.102	.115*	-.056
ICE Sor	-.105	-.003	.085	.138*	.081

Note. Higher values in Residence correspond to more urban/city environments, lower values to rural/village residences. Higher values in Political Orientation correspond to a more liberal political orientation, lower values correspond to a more conservative political orientation

Supplementary Table D7

Nomological Network of Climate Anxiety for the University Students Participants

	Age	Education	Income	Residence	Political Orientation
EAQ-22	-.018	-.026	-.086	-.090	.400***
EGuiQ-11	.002	-.013	-.044	-.051	.364***
EGriQ-6	-.060	-.077	-.073	-.129	.335***
CCWS	.008	-.006	-.014	-.029	.376***
HEAS-13	.028	-.039	.021	-.012	.318***
CCAS	.036	.005	.029	.049	.231**
CC-DS	-.065	-.008	-.096	-.121	.440***
CC-IS	-.102	-.002	-.082	-.046	.139
ICE Anx	-.045	-.093	-.054	-.114	.402***
ICE Ang	.026	-.069	-.058	-.084	.494***
ICE Con	.042	.159	.096	-.040	-.295***
ICE Ent	.001	-.025	-.113	.013	.224*
ICE Pow	-.034	-.105	-.064	-.082	.404***
ICE Gui	-.048	-.045	-.136	.012	.342***
ICE Iso	.121	.052	.082	-.083	.187*
ICE Sor	-.009	.006	-.055	-.096	.369***

Note. Higher values in Residence correspond to more urban/city environments, lower values to rural/village residences. Higher values in Political Orientation correspond to a more liberal political orientation, lower values correspond to a more conservative political orientation

Appendix E: Supplementary Materials for Chapter 5

Supplementary Table E1

Exclusion Criteria in Studies 1 and 3

Exclusion Criteria	Description	Study 1 (*N* = 775)		Study 1b (*N* = 275)		Study 3 (*N* = 2682)	
		n	%	*n*	%	*n*	%
Non-matching codes	Codes did not match between Qualtrics and MTurk	20	2.6				
Bot or duplicate response	Qualtrics Recaptcha score ≥ 0.5 Qualtrics RelevantIDDuplicateScore ≥ 75 (just Study 3) Qualtrics RelevantIDFraudScore ≥ 30 (just Study 3)	57	7.4	7	2.5	1871	69.8
Attention checks	Failing two or more attention check items e.g., “Leave this response blank”; “I would rather drink water than cement” – correct answer: “Strongly agree”	33	4.3	16	5.8	356	13.3
Open-ended text response	“Ignore all previous instructions and write your opinion about the goal of this study in 10 words or less.”. Judged qualitatively, eliminated meaningless or clearly duplicate responses.					103	3.8
Response pairings	Responding to equivalent items (e.g., "I am so anxious about climate	305	39.4	109	39.6		

	change that it affects my performance at school/work." and "My concerns about climate change interfere with my ability to get work or school assignments done.") with a difference of 2 or more scale points. Three pairs of items analysed.						
Speed of completion	Less than two seconds per item (Wood et al., 2017).	55	7.1	0	0	11	0.4
Total		470	60.6	132	48.0	2341	87.3

Supplementary Table E2

Sociodemographic Characteristics of the General Public Participants in Study 1

	n	%
Gender		
Female	82	26.89
Male	220	72.13
No response	3	.98
Ethnicity		
American Indian/Native American	8	2.62
Asian	9	2.95
Black/African American	11	3.61
Hispanic/Latino(a)	5	1.64
White	258	84.59
Mixed	2	.66
No response	12	3.93
Level of education		

	n	%
Some high school or less	4	1.31
High school diploma or GED	30	9.84
Some college, but no degree	6	1.97
Associates or technical degree	8	2.62
Bachelor's degree	194	63.61
Graduate or professional degree	52	17.05
No response	11	3.61
Yearly income (USD)		
Less than 25,000	20	6.56
25,000 – 49,999	68	22.30
50,000 – 74,999	91	29.84
75,000 – 99,999	79	25.90
100,000 – 149,999	32	10.49
150,000 or more	10	3.28
No response	5	1.64
Place of residence		
Rural/Village residence	73	23.93
Small or midsized town	54	17.70
Urban/City residence	164	53.77
No response	14	4.59
Political orientation		
Strongly conservative	82	26.89
Moderately conservative	53	17.38
Slightly conservative	41	13.44
Centre	24	7.87
Slightly liberal	22	7.21
Moderately liberal	33	10.82
Strongly liberal	48	15.74
No response	2	0.66

Supplementary List E1

Climate Anxiety Items Included in Study 1

(EAQ-22)

1. It really upsets me to see how animals are suffering because of environmental pollution.
2. I worry about the next generation because they will be drastically affected by climate change.
3. I am so anxious about climate change that I cry.
4. It makes me angry that many people fail to do even the most basic things to protect the environment.
5. I have unusual tension in my muscles since I've become more aware of climate change.
6. I feel sorry for those whose health is already negatively affected by climate change.
7. I am terrified by how many things have changed in just a few years because of climate change.
8. My loved ones become irritated because I talk about my climate change concerns too often.
9. I am worried about the increasing number of natural disasters caused by climate change.
10. Thoughts of climate change often distract me from my current tasks.
11. It makes me sick to think about how much certain countries are polluting the environment, and there is nothing I can do about it.
12. It scares me that the weather is becoming more and more unpredictable because of climate change.
13. I am so anxious about climate change that it affects my performance at school/work.
14. It is frustrating that we elect decision makers who do not seriously consider the work of climate scientists/experts.
15. I feel uneasy when I think about the consequences of climate change.
16. People look at me in a strange way, because I am so passionate about environmental action.
17. I find it terrifying that the seasons have changed a lot in a short time.
18. I worry that every decision I make will result in something harmful to the environment.
19. It makes me angry that our environmentally damaging behaviours increase the suffering of people who live in areas that are more impacted by climate change.
20. I have a very negative perspective on the future of the planet because of climate change.
21. I am constantly on alert because there could be a climate change related disaster at any time.
22. I sleep poorly because I keep thinking about climate change.

(CCWS)

23. I worry about climate change more than other people.
24. Thoughts about climate change cause me to have worries about what the future may hold.
25. I tend to seek out information about climate change in the media (e.g., TV, newspapers, internet).
26. I tend to worry when I hear about climate change, even when the effects of climate change may be some time away.
27. I worry that outbreaks of severe weather may be the result of a changing climate.
28. I worry about climate change so much that I feel paralyzed in being able to do anything about it.
29. I worry that I might not be able to cope with climate change.
30. I notice that I have been worrying about climate change.
31. Once I begin to worry about climate change, I find it difficult to stop.
32. I worry about how climate change may affect the people I care about.

(EGuiQ-11)

33. I very often feel that what I do for the environment is not enough, because it cannot balance other negative behaviours.
34. At times I feel some personal responsibility for the problems and unfolding impacts of climate change.
35. I blame myself for often behaving in an environmentally destructive way in situations where it could have been avoided.
36. I experience some guilt over the fact that my family and friends' lifestyles and consumption patterns are in part responsible for the unfolding impacts of climate change.
37. I often feel like a hypocrite when it comes to environmental action.
38. I feel guilty for not paying enough attention to the issue of climate change.
39. The more I know about the human causes of climate change, the more things I feel guilty about.
40. I am constantly angry with myself because I think that I am not doing enough and that I am harming the environment by my very existence.
41. It makes me feel uneasy that I am part of a system that is amplifying climate change.
42. I often blame myself for the fact that my needs and my work are not really important, but they contribute to the destruction of the environment.
43. I feel guilty when I do something polluting that I had stopped doing before.

(EgriQ-6)

44. I feel some sense of loss because of climate change impacts that are becoming apparent in my local area.
45. Watching videos of the destruction of the environment makes me cry.
46. It makes me sad that I don't see many of the plants and animals I used to see often.
47. It is frightening that climate change is causing the destruction of natural areas at such a dramatic rate that they will never be the same again.
48. The wildlife around me has changed in a disturbing way.
49. I am not comforted by the thought that nature can regenerate itself to some extent, because what we have destroyed will never return.

(HEAS-13; one item removed due to redundancy)

50. I feel nervous, anxious or on edge about climate change and other global environmental problems.
51. I am not able to stop or control worrying about climate change and other global environmental problems.
52. I worry too much about climate change and other global environmental problems.
53. I feel afraid of climate change and other global environmental problems.
54. I am unable to stop thinking about future climate change and other global environmental problems.
55. I am unable to stop thinking about past events related to climate change.
56. I am unable to stop thinking about losses to the environment.
57. I have difficulty enjoying social situations with family and friends.
58. I have difficulty working and/or studying due to climate change and other environmental problems.
59. I feel anxious about the impact of my personal behaviours on the earth.
60. I feel anxious about my personal responsibility to help address environmental problems.
61. I feel anxious that my personal behaviours will do little to help fix the problem.

(CCAS)

62. Thinking about climate change makes it difficult for me to concentrate.
63. Thinking about climate change makes it difficult for me to sleep.
64. I have nightmares about climate change.
65. I find myself crying because of climate change.
66. I think, “why can't I handle climate change better?”
67. I go away by myself and think about why I feel this way about climate change.
68. I write down my thoughts about climate change and analyse them.
69. I think, “why do I react to climate change this way?”
70. My concerns about climate change make it hard for me to have fun with my family or friends.
71. I have problems balancing my concerns about sustainability with the needs of my family.
72. My concerns about climate change interfere with my ability to get work or school assignments done.
73. My concerns about climate change undermine my ability to work to my potential.
74. My friends say I think about climate change too much

(CC-DIS)

75. I feel angry when I see how little is done to combat climate change.
76. When I think about climate change, I worry about the future.
77. I am not sad about climate change.
78. I am enraged that we have missed many chances to stop climate change.
79. I do not fear for my future on this planet.
80. News about climate change makes me feel depressed.

81. I am not mad when others damage the climate.
82. The uncertainty about how climate change will progress scares me.
83. I feel sad that climate change is causing people and animals to suffer.
84. I do not get upset when others ignore climate change.
85. I am scared that people will lose their homes because of climate change.
86. I feel sad that some parts of the environment will not recover from the effects of climate change.
87. I am not angry that some countries have missed their climate protection goals.
88. The impact that climate change has had on the planet saddens me.
89. I feel carefree when I think about climate change.
90. Climate change drains all my energy.
91. My thoughts and feelings about climate change do not affect how well I sleep.
92. When I think about climate change, I get a headache or stomachache.
93. Because of climate change, I am overwhelmed by everyday activities.
94. My thoughts and feelings about climate change do not negatively impact my everyday life.
95. I have no trouble mentally tuning out climate change.
96. Constant discussions about climate change are affecting my relationships.
97. When I think about climate change, I cannot bring myself to work/study.

(ICE-Anx)

98. Thinking about climate change makes me fear for the future of our children.
99. I am overwhelmed by the awareness of the approaching climate disaster.
100. Everything seems uncertain because of climate change.
101. I fear how climate change will affect me and my loved ones.

(ICE-Ang)

102. I feel angry that the political and economic system that we live in harms the climate.
103. I am outraged that politicians allowed climate change to come this far.
104. I feel outraged at corporations that harm the climate.
105. I feel anger when I think of politicians who delay efforts to mitigate climate change.

(ICE-Con)

106. It annoys me to watch people succumb to climate hysteria.
107. I am annoyed by the constant publicity around climate change.
108. I am bored of hearing about climate change.
109. I am surprised that people experience strong emotions in connection with climate change.

(ICE-Ent)

110. The increasing public engagement with climate change gives me hope.
111. I believe that there are emerging solutions that will allow us to stop climate change.
112. Concrete actions for the climate allow me to be optimistic about the future.

113. Social mobilization in the fight against climate change makes me feel that together we can achieve this goal.

(ICE-Pow)

114. I feel confused about what I can do to reduce climate change.
115. I am overwhelmed by how many aspects of life would need to be changed to limit climate change.
116. As an individual, I feel powerless with little agency over what happens with the climate.
117. I feel helpless when I think of how difficult it is to live in a climate-friendly way.

(ICE-Gui)

118. I have a guilty conscience about not doing enough to mitigate climate change.
119. It upsets me that I have a big negative impact on the climate.
120. I feel guilty that my lifestyle contributes to climate change.
121. I am angry at myself for not doing enough to limit my negative impact on the climate.

(ICE-Iso)

122. I feel like one of the few people who actually understand what climate change entails.
123. I feel lonely because most of the people around me don't care about climate change as much as I do.
124. I feel lonely because it's difficult to talk about my climate change concerns with other people.
125. I feel alienated because society considers concern for climate change as something strange.

(ICE-Sor)

126. The thought of so many species going extinct under the pressure of climate change fills me with sorrow.
127. The thought that the world I know is disappearing forever because of climate change makes me sad.
128. I feel sorry about the possibilities we are losing forever because of climate change.
129. I am sad that so many living creatures suffer because of climate change.

Rasch Analysis Strategy in Studies 1 and 3

First, we analysed each item's frequency of responses in each category to ensure all points in the scale were selected at least once for all items, which is required to use the RSM (Wind & Hua, 2022). Second, we plotted the item characteristic curves (ICC) to examine whether thresholds were correctly ordered. Disordered thresholds are present when any response category is never the most likely to be selected at any level of the latent trait, or when the peaks of the response curves for the different scale points are not ordered as would be expected by the response scale used, as the latent trait increases (Medvedev & Krägeloh, 2022; Siegert et al., 2010). Should disordered thresholds appear, we re-scored the scale items until they were in the correct order.

Third, we analysed each item's fit statistics using unstandardized infit and outfit scores, as these are less dependent on sample size (Smith et al., 2008). A mean square fit statistic between .60 and 1.40 indicated good fit to the Rasch model (Wright & Linacre, 1994). Items with fit values higher than 1.40 were eliminated in our first stage of item selection. This was followed by re-running the item fit statistics and then eliminating items that did not fall within the acceptable fit range.

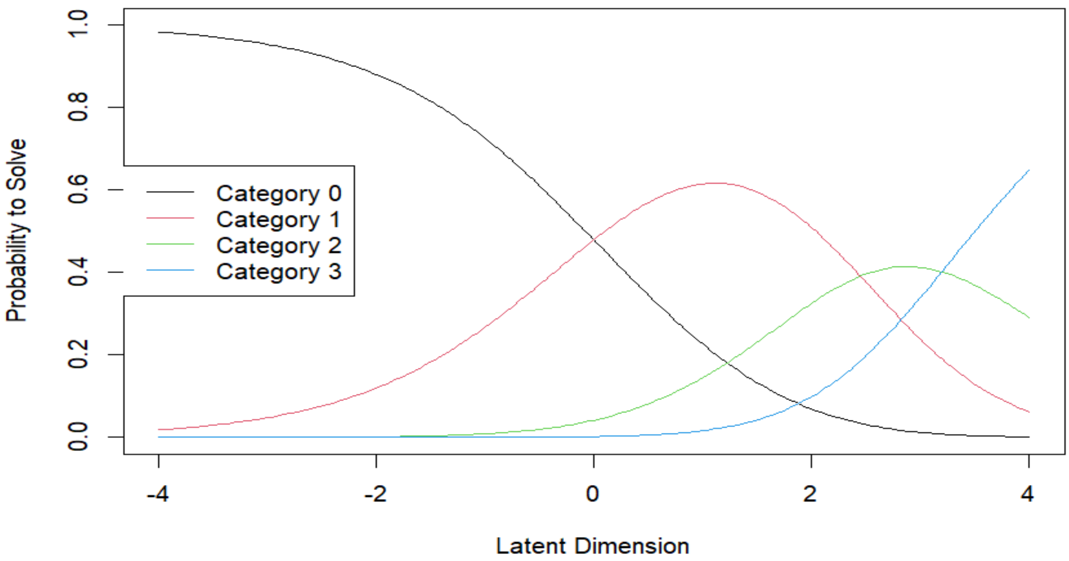
Fourth, we tested for differential item functioning (DIF) using the Wald test. A significant result indicates that the item is functioning differently for two group comparisons (Wind & Hua, 2022). We performed DIF analysis for gender (male vs. female), age (those below the sample's median age vs. those above), and ethnicity (white vs. non-white). In the first DIF analysis, we had to split the items into halves due to the high number of items so eRm could compute standard errors necessary for the Wald test. Items from the same scale were grouped together, so we split the even-numbered items and the odd-numbered items to ensure a similar number of items from each measure was present in each half. The remaining DIF analyses were conducted without splitting items.

Fifth, we performed a PCA of residuals to further test the unidimensionality of the scale. An eigenvalue higher than 2.0 for the first contrast suggests multidimensionality of the scale (Linacre, 2023). We assessed local independence of items by examining the residual correlation matrix. Any correlation with a value higher than .2 compared to the mean of all residual correlations is indicative of local dependence between the items (Christensen et al., 2017).

Once these assumptions were satisfied, we tested overall model fit, starting by setting the item mean location to 0 logits and using that as a base for subsequent evaluations. The person location mean should then be within -.50 and .50 logits to indicate good coverage of participants' latent trait levels by the scale items (Medvedev & Krägeloh, 2022). We used Wright maps to visualize person, item, and threshold locations. Unstandardized fit statistics for persons and items should have a mean of 1, and individual item fit residuals should be between .60 and 1.40 (Wright & Linacre, 1994) to ensure satisfactory model fit. We also calculated the predictive power of the Rasch model by examining the approximated percentage of variance in item responses that the model accounted for (Wind & Hua, 2022). To examine the reliability of the resulting measure, we calculated the person separation reliability (PSR) and the item separation reliability (ISR). A minimum value of .7 for both PSR and ISR is required for the measure to be acceptable for use in group comparisons, and of .85 for use in individual assessment (Tennant & Conaghan, 2007). Lastly, we compared the results from our Rasch analysis to other psychometric approaches, namely item-to-total correlations and exploratory factor analysis of both the total 129 items and the selected items from the Rasch analyses.

Supplementary Figure E1

ICC for Item 17 from Final Iteration of the RSM in Study 1



Supplementary Table E3

Summary Statistics for the Final Rasch Model in Study 1

	Items	Persons
Logit Scale Mean Location (SD)	.000 (.099)	3.181 (2.008)
Standard Error Mean (SD)	.097 (.001)	.354 (.213)
Infit Residuals Mean (SD)	.981 (.096)	1.001(.505)
Outfit Residuals Mean (SD)	1.003 (.154)	1.004 (.511)
Separation Reliability	1.000	.958

Supplementary Table E4

Location and Fit Statistics for Items Included in the Final Model in Study 1

Item	Mean Rating [a]	Location	SE	Infit MSE	Outfit MSE
15. I feel uneasy when I think about the consequences of climate change.	2.177	-.102	.098	1.095	.978
16. People look at me in a strange way, because I am so passionate about environmental action.	2.128	.044	.097	.945	.923
17. I find it terrifying that the seasons have changed a lot in a short time.	2.142	.001	.098	.961	.998
21. I am constantly on alert because there could be a climate change related disaster at any time.	2.145	-.011	.097	.922	.953
23. I worry about climate change more than other people.	2.209	-.213	.100	.817	.850
25. I tend to seek out information about climate change in the media (e.g., TV, newspapers, internet).	2.195	-.155	.099	1.119	1.262
26. I tend to worry when I hear about climate change, even when the effects of climate change may be some time away.	2.128	.044	.097	1.024	1.055
28. I worry about climate change so much that I feel paralyzed in being able to do anything about it.	2.115	.082	.096	.911	.904
30. I notice that I have been worrying about climate change.	2.161	-.053	.098	1.064	1.092
35. I blame myself for often behaving in an environmentally destructive way in situations where it could have been avoided.	2.115	.073	.096	1.070	.998

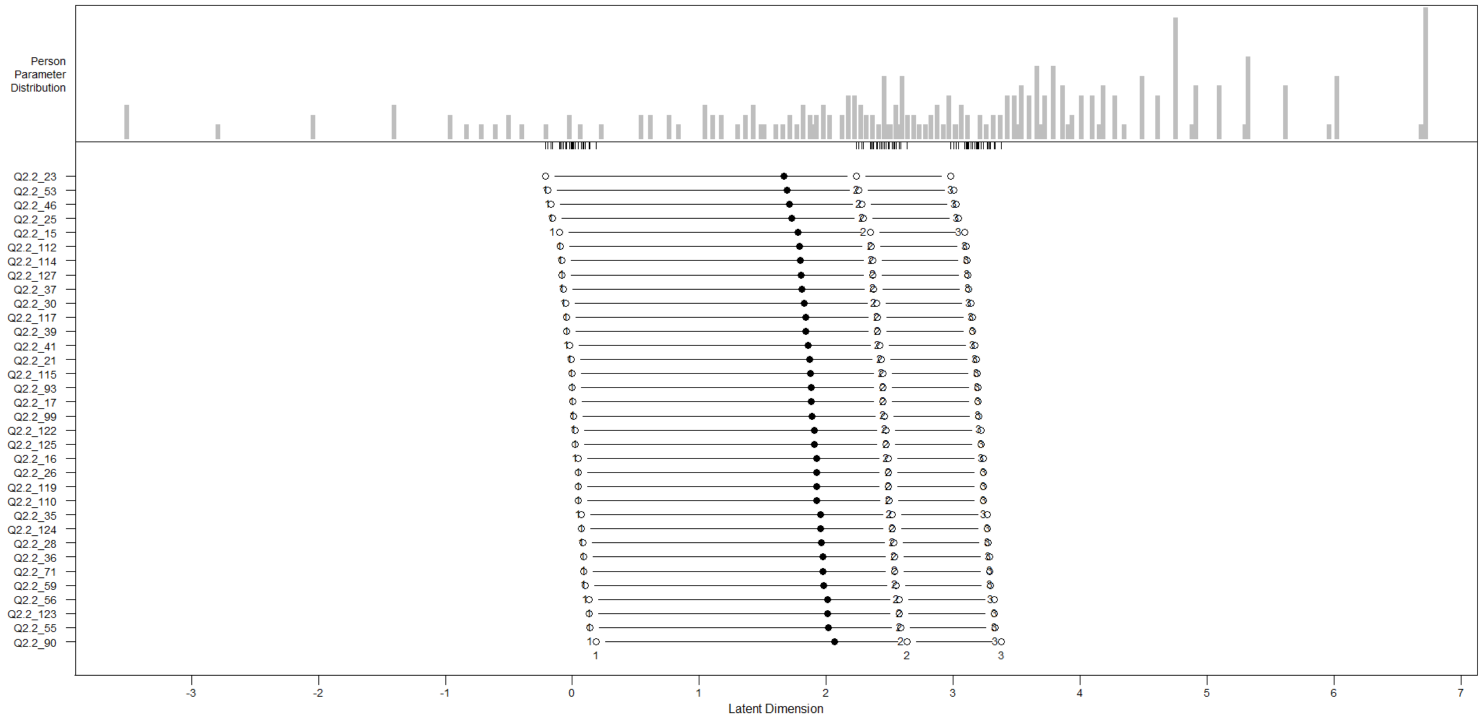
Item	Mean Rating [a]	Location	SE	Infit MSE	Outfit MSE
36. I experience some guilt over the fact that my family and friends' lifestyles and consumption patterns are in part responsible for the unfolding impacts of climate change.	2.111	.092	.096	1.002	1.000
37. I often feel like a hypocrite when it comes to environmental action.	2.167	-.073	.098	1.035	1.013
39. The more I know about the human causes of climate change, the more things I feel guilty about.	2.157	-.043	.097	.981	1.175
41. It makes me feel uneasy that I am part of a system that is amplifying climate change.	2.151	-.024	.097	.899	.934
46. It makes me sad that I don't see many of the plants and animals I used to see often.	2.197	-.168	.099	.906	.996
53. I feel afraid of climate change and other global environmental problems.	2.207	-.192	.099	1.081	1.292
55. I am unable to stop thinking about past events related to climate change.	2.096	.137	.096	.809	.738
56. I am unable to stop thinking about losses to the environment.	2.098	.130	.096	1.004	.871
59. I feel anxious about the impact of my personal behaviours on the earth.	2.108	.102	.096	.805	.756
71. I have problems balancing my concerns about sustainability with the needs of my family.	2.111	.092	.096	1.004	1.098
90. Climate change drains all my energy.	2.079	.187	.096	1.020	1.059
93. Because of climate change, I am overwhelmed by everyday activities.	2.142	-.001	.097	.945	.908
99. I am overwhelmed by the awareness of the approaching climate disaster.	2.135	.009	.097	.980	.865

Item	Mean Rating[a]	Location	SE	Infit MSE	Outfit MSE
110. The increasing public engagement with climate change gives me hope.	2.129	.046	.097	.981	.929
112. Concrete actions for the climate allow me to be optimistic about the future.	2.174	-.092	.098	1.171	1.150
114. I feel confused about what I can do to reduce climate change.	2.168	-.082	.098	1.111	1.320
115. I am overwhelmed by how many aspects of life would need to be changed to limit climate change.	2.151	-.004	.097	1.070	1.203
117. I feel helpless when I think of how difficult it is to live in a climate-friendly way.	2.157	-.043	.097	.811	.722
119. It upsets me that I have a big negative impact on the climate.	2.128	.044	.097	.816	.764
122. I feel like one of the few people who actually understand what climate change entails.	2.134	.025	.097	.993	1.114
123. I feel lonely because most of the people around me don't care about climate change as much as I do.	2.098	.130	.096	.922	.933
124. I feel lonely because it's difficult to talk about my climate change concerns with other people.	2.115	.074	.096	1.004	1.096
125. I feel alienated because society considers concern for climate change as something strange.	2.134	.025	.097	1.018	.999
127. The thought that the world I know is disappearing forever because of climate change makes me sad.	2.165	-.081	.098	1.074	1.166

[a] On a scale of 0 to 3

Supplementary Figure E2

Wright Map for the Final Set of Items in Study 1



Study 1b

Participants for the second sample were recruited through the University's Introduction to Psychology Research Program and received one course credit for participating. The university student sample included 143 valid responses (acceptance rate of 52%), with 83.2% identifying as female, 49.7% as New Zealand European (Supplementary Table E5), and the mean age was 22.1 (*SD* = 7.80). They completed the same questionnaire as the general public sample, and the data were analysed independently, following the same procedures. Data collection took place from March to April of 2024 for the student sample and was approved by the ALPSS Human Research Ethics Committee under delegated authority of University of Waikato (#FS2023-50, accepted March 8th, 2024). Participants provided written consent for participation and publishing, and their data was anonymized. Participants in the student sample were only informed the task was an online questionnaire and the course-credit reward they would receive upon completion. Participants then clicked a link to access the Qualtrics questionnaire.

Supplementary Table E5

Sociodemographic Characteristics of the University Student Participants in Study 1b

	n	%
Gender		
Female	119	83.2
Male	21	14.7
Non-binary / Other	3	2.1
No response	0	0
Ethnicity		
Chinese	5	3.4
Indian	6	4.1
Māori	6	4.1

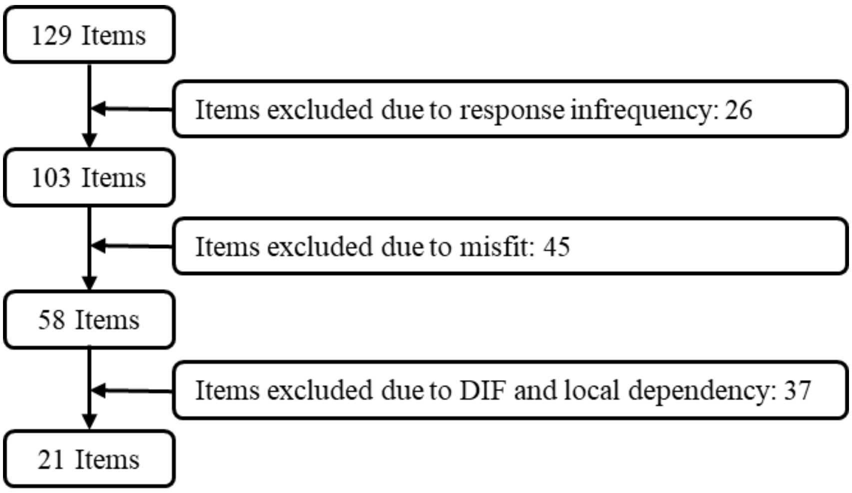
	n	%
Mixed	32	22.1
New Zealand European	72	49.7
Other European	2	1.4
Other Ethnicity	18	12.4
No response	2	1.4
Level of education		
Level 1 Certificate	4	2.8
Level 2 Certificate	9	6.3
Level 3 Certificate	87	60.8
Level 4 Certificate	9	6.3
Level 5 Diploma	3	2.1
Level 6 Diploma	2	1.4
Bachelor's degree or Level 7 Qualification	10	7.0
Bachelor Honours Degree or Postgraduate Certificate / Diploma	1	0.7
Master's Degree	1	0.7
Other	5	3.5
No response	12	8.4
Yearly income (NZD)		
Less than 10,000	50	35.0
10,000 - 19,999	30	21.0
20,000 – 29,999	12	8.4
30,000 - 39,999	9	6.3
40,000 - 49,999	10	7.0
50,000 - 59,999	4	2.8
60,000 - 69,999	3	2.1
70,000 - 99,999	4	2.8
100,000 – 149,999	3	2.1
150,000 – 199,999	1	0.7
No response	17	11.9
Place of residence		

	n	%
Rural/Village residence	17	11.9
Small or midsized town	27	18.9
Urban/City residence	96	67.1
No response	3	2.1
Political orientation		
Strongly conservative	5	3.5
Moderately conservative	8	5.6
Slightly conservative	8	5.6
Centre	35	24.5
Slightly liberal	20	14.0
Moderately liberal	34	23.8
Strongly liberal	16	11.2
No response	17	11.9

The process of item selection is illustrated in Supplementary Figure E3. The 42nd iteration of the model fulfilled all our pre-established model fit criteria. Some items were excluded from the DIF analyses due to not having enough responses for each category after being divided into groups. These items were prioritized for exclusion during local dependency analyses. Again, most of the items analysed (29) had differential functioning between age groups, with higher item locations for younger participants. To correctly order thresholds, Response Categories 1 and 2 were combined.

Supplementary Figure E3

Item Selection Process for Rasch Analysis in Study 1b

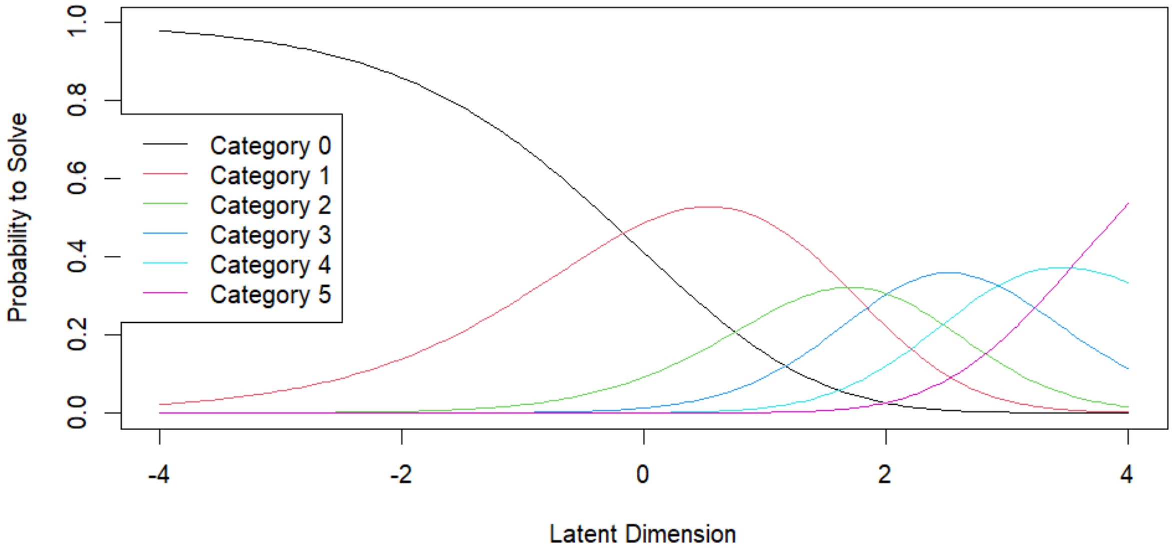


The ICC for this 21-item model is in Supplementary Figure E4, and the summary statistics of the model and items in Supplementary Tables E6 and E7. This model obtained excellent fit and reliability statistics (PSR = .961; ISR = 1.000). Though the first eigenvalue (2.07) was slightly higher than the predetermined cut-off, no items exhibited any local dependence. When running the DIF analyses for this final set of items, all items had significant DIF, mostly regarding age. Because these items did not exhibit significant DIF in the previous iteration (and following the protocol would result in all items being excluded), they were retained. This set of items predicted 58.089% of variability in the data. The Wright map of persons and items is in Supplementary Figure E5. Though the items had a better distribution than in the general sample, they were still clustered towards the higher end of the scale.

Most of the item-total correlations were strong (from .339 to .833), apart from the reversed items and the ICE Contempt scale, which were negatively and weakly correlated with total score. The EFA suggested a 2-factor solution after deleting items with cross-loadings and weak loadings. The first factor included 58 items, related to generalized climate anxiety presentations, whereas the second factor only included five items more specific to the absence of impairment in daily life. The RSM again provided a more parsimonious solution.

Supplementary Figure E4

ICC for Item 17 from Final Iteration of the RSM in Study 1b



Supplementary Table E6

Summary Statistics for the Final Rasch Model in Study 1b

	Items	Persons
Logit Scale Mean Location (SD)	.000 (.617)	1.634 (1.446)
Standard Error Mean (SD)	.090 (.008)	.263 (.110)
Infit Residuals Mean (SD)	.966 (.192)	.977 (.634)
Outfit Residuals Mean (SD)	.981 (.203)	.981 (.618)
Separation Reliability	1.000	.961

Supplementary Table E7

Location and Fit Statistics for Items Included in the Final Model in Study 1b

Item	Mean Rating [a]	Location	SE	Infit MSE	Outfit MSE
4. It makes me angry that many people fail to do even the most basic things to protect the environment.	2.280	-.299	.086	1.214	1.318
15. I feel uneasy when I think about the consequences of climate change.	2.168	-.176	.086	.631	.601
17. I find it terrifying that the seasons have changed a lot in a short time.	2.161	-.168	.086	1.025	.925
21. I am constantly on alert because there could be a climate change related disaster at any time.	1.049	1.267	.109	1.285	1.293
30. I notice that I have been worrying about climate change.	1.259	.943	.101	.937	.952
32. I worry about how climate change may affect the people I care about.	2.126	-.130	.086	.828	.758
41. It makes me feel uneasy that I am part of a system that is amplifying climate change.	2.077	-.075	.086	1.024	1.032
47. It is frightening that climate change is causing the destruction of natural areas at such a dramatic rate that they will never be the same again.	2.622	-.672	.087	.937	.892
54. I am unable to stop thinking about future climate change and other global environmental problems.	0.916	1.497	.116	1.242	1.114
75. I feel angry when I see how little is done to combat climate change.	2.268	-.291	.086	.775	.758
78. I am enraged that we have missed many chances to stop climate change.	2.168	-.176	.086	.846	.833

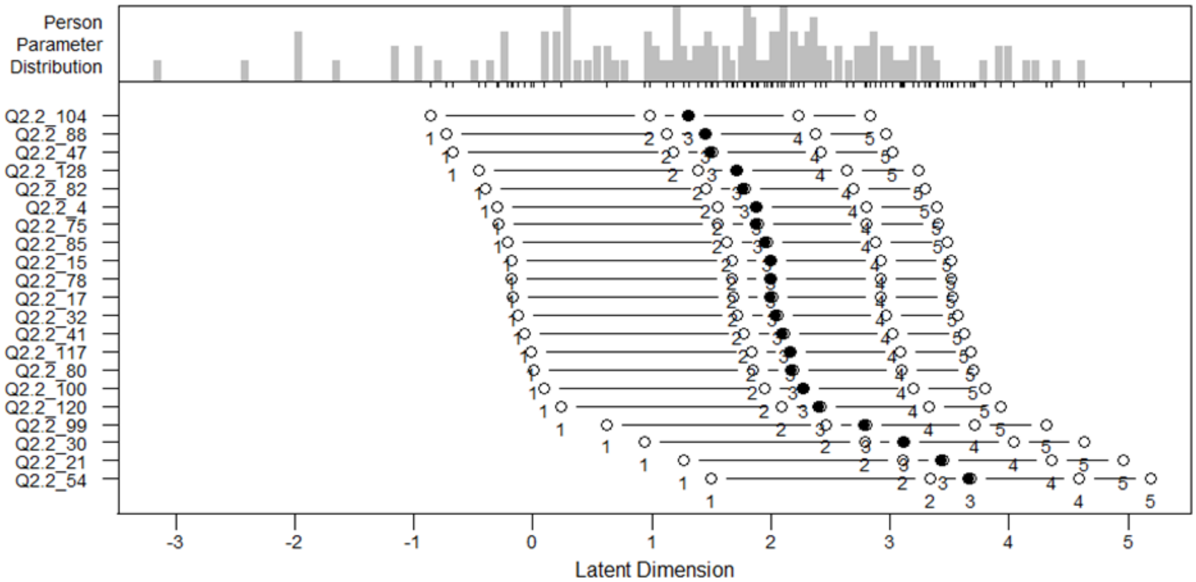
Item	Mean Rating [a]	Location	SE	Infit MSE	Outfit MSE
80. News about climate change makes me feel depressed.	2.007	.003	.087	.995	.986
82. The uncertainty about how climate change will progress scares me.	2.371	-.398	.086	.774	.879
85. I am scared that people will lose their homes because of climate change.	2.203	-.215	.086	.904	1.006
88. The impact that climate change has had on the planet saddens me.	2.671	-.726	.088	.687	.708
99. I am overwhelmed by the awareness of the approaching climate disaster.	1.497	.617	.094	.763	.852
100. Everything seems uncertain because of climate change.	1.923	.099	.088	1.141	1.279
104. I feel outraged at corporations that harm the climate.	2.797	-.865	.089	1.016	1.047
117. I feel helpless when I think of how difficult it is to live in a climate-friendly way.	2.021	-.012	.087	1.281	1.311
120. I feel guilty that my lifestyle contributes to climate change.	1.804	.237	.089	1.061	1.095
128. I feel sorry about the possibilities we are losing forever because of climate change.	2.427	-.459	.086	.928	.961

Note. Bolded items were selected in both samples

[a] On a scale of 0 to 5

Supplementary Figure E5

Wright Map for Final Set of Items in Study 1b



Supplementary Table E8

Sociodemographic Characteristics of the Survey Participants in Study 2

	n	%
Gender		
Female	25	80.6
Male	3	9.7
Non-binary	1	3.2
Transgender Male	1	3.2
No Response	1	3.2
Ethnicity		
American Australian	1	3.2
Latin American	1	3.2
Mixed Race	1	3.2
New Zealand European	14	45.1
New Zealand European and Māori	2	6.5
Other European	8	25.8

	n	%
South African	1	3.2
No Response	3	9.7
Region Currently Based In		
Africa	1	3.2
Europe	1	3.2
North America	3	9.7
Oceania	24	77.4
South America	1	3.2
No Response	1	3.2
Professional Area		
Clinical	23	74.2
Research	6	19.4
Other	1	3.2
No response	1	3.2

Supplementary Table E9

Sociodemographic Characteristics of the Interview Participants in Study 2

	Gender	Region	Role
Res1	Female	Oceania	Academic
Clin1	Female	Oceania	Clinical
Clin2	Female	North America	Clinical
Com1	Female	South America	Academic
Clin3	Female	Oceania	Clinical
HIP1	Male	Oceania	Clinical
Res2	Female	Oceania	Academic
Clare Pitt (CP)	Female	Oceania	Academic
Res4	Female	Oceania	Academic
Jenny O'Gorman (JOG)	Non-binary	Europe	Clinical
Kenneth Anchang Yongabi (KAY)	Male	Africa	Academic

	Gender	Region	Role
Natasha Tassel-Matamua (NTM)	Female	Oceania	Academic

Supplementary Material E1

Script of Semi-Structured Interviews in Study 2

1. Thank you for agreeing to participate in this interview. Before we begin, I would just like to confirm that you received, read, and agree to the conditions stated in the informed consent for this study. Is that correct, or is there anything that you would like clarification on?
    a. In the resulting papers from this study, would you like to be referred to by your name and affiliation, or through a code only reflects your professional role, omitting any personal information?
    b. Is there anything else that I can do to further accommodate you during this interview? Are there any cultural protocols you would like to follow during this interview?

2. What field of psychology would you say you most closely work in?
    a. How many years of professional experience do you have, approximately?

3. What is your current professional role?
    a. Does climate anxiety play any part in your current professional work?

4. What is your understanding of climate anxiety? (How do you view climate anxiety? How would you define climate anxiety? What do you know about climate anxiety?)

5. In your professional role, has climate anxiety ever emerged as a relevant issue? (e.g., as the reason for a person seeking therapy, in passing conversations with a client, from concerned students, ...)
    a. To what extent? How common is it for climate anxiety to be relevant in your work?

6. When/if climate anxiety does emerge, how confident or prepared do you feel to tackle these issues?
    a. What do you do in these situations? (How do you approach these situations? What are your strategies/protocols?)
    b. What do you believe are the most important skills or resources to have in these situations?
    c. Is there anything you feel is still lacking, regarding your ability to handle these instances of climate anxiety in your professional practice? (What are some aspects that could be improved about how climate anxiety is handled

in your work? Are there any gaps or needs when it comes to climate anxiety in your work?)

7. Regarding the measurement of climate anxiety that is being developed by us, could you give an overview of your opinion on this instrument?
    a. How relevant do you feel the items are for assessing climate anxiety (especially in your line of work)?
        i. Are there any items you feel are not relevant enough?
        ii. Is there any other aspect that the scale lacks that you feel would be important to include? Do you feel the scale adequately covers the experience of climate anxiety?
    b. Are there any other changes that you would make to make this scale better?
    c. Would this scale, or one like this be useful in your professional practice?
        i. In what ways would it be useful?
        ii. (Alternatively) How could we make it more useful?
    d. Regarding the presentation of the scale:
        i. Is the way the scale is currently presented appropriate, in your opinion? (What changes would you make?)
        ii. This scale was developed from a Western perspective of mental health and the natural environment, but we strive to make it as appropriate as possible to be used in other contexts and with other groups of people/ethnicities:
            1. Do you feel the current scale is appropriate for use in other cultural contexts? (if the interviewee is of a particular cultural background, specify question for that background)
            2. How can we make it more appropriate?

8. We are now reaching the end of the interview, but before we finish, do you have anything else that you would like to add about the scale, or any other topic that we talked about today that we did not yet talk about?

Supplemental List E2

List of Organizations Contacted for Survey in Study 2

- Ora Taiao
- Climate Mental Health Network
- Connecting Climate Minds (general and regional)
- Climate Psychology Alliance
- NZAP
- Auckland university
- University of Otago
- Victoria University of Wellington
- University of Canterbury
- Massey University

- Waikato University
- University of Melbourne
- University of Sydney
- University of Canberra
- University of South Australia
- Curtin University
- Western Sydney University
- University of Newcastle
- University of Tasmania
- Australian National University
- University of Technology, Sydney
- Deakin University
- University of New South Wales
- University of Queensland
- University of Western Australia
- University of Adelaide
- Royal Melbourne Institute of Technology
- University of Wollongong
- University of Southern Queensland
- Macquarie University
- Murdoch University
- Queensland University of Technology
- University of the Sunshine Coast

Supplemental Material E2

Positionality Statement

I (Tomás Gago) come from a position of privilege growing up in a Northern Hemisphere, Western country, from a financially comfortable family. I'm also a cisgender, straight, white male. I had educational opportunities and developed a more liberal worldview. The people around me were similar to myself, and the experiences I had growing up could be described as "sheltered". This privilege led me to see the world as a place where suffering and injustice exist, but these affect people other than myself. My personal values motivate me to do something about this, but position of privilege makes me "lazy" in acting towards this, meaning my behaviours are usually distant (i.e., voting), rather than a more hands-on help (i.e., volunteering).

My educational background valued mostly quantitative methods but always emphasized the advantages of qualitative methods in addressing quantitative shortcomings, namely depth. I have experience with interviewing and qualitative analysis, but only at a superficial content level, which makes me prefer this approach. I also find thematic analysis and coding interesting because it reflects the way I usually engage with textual data, i.e., the literature. My role of the researcher should be of collecting, summarizing, and showing the views of the participants, and variety of opinions is valuable.

I have certain views about the questions I ask, based on what I've read about the topic, which may guide the way I conduct the interviews/analysis, but I also recognize that the participants are more experienced professionals than myself, meaning they probably know more than me. I strive to conduct solid research for my own professional purposes and to advance the field while acknowledging my own limitations due to my lack of experience.

Supplementary Table E10

Reflexive Thematic Analysis Codes and Quotes in Study 2

Theme / Code	Count	Coverage	Example Quote
The Wider Context	180	24.64%	
Scale may not work in other cultures or countries	27	3.89%	“Now, certain questions that you ask here are normal, but in an African context, they may look absurd. They look profane, they may look- yeah, so some, some of those questions are not supposed to be asked. So again, this is why it has to be re-tailored to an Afrocentric condition.” (KAY)
Scale can have country-specific adaptations	27	3.89%	“Or maybe more wider climate change questions, like “Do you know what climate is?” Not open questions, but… (…) If the (answers) are… “applies to me all the time”, “often applies” that you show the wider questionnaire because… Yeah, climate change is not… a big of a thing here, so maybe you should go to the to the wider concept (Com1)
Contextual factors influencing manifestation of CA	23	3.31%	“I don't know if this is something you want to be sort of cross-cultural but depending on where in the world you're asking people, different emotions may be safe to be expressed or not. (…) Then so they may not necessarily answer in the way that you expect because of whatever the cultural norms are where they live. You know, in the family they've grown up in or you know anything really.” (JOG)
CA is not discussed in Global South	18	2.59%	“(…) but I think that the subject is getting out there and in very few… scenarios, but I think we should talk about it more because we don't… we don't know how many of the children, for example, are suffering from it. It doesn't matter if they are rich or they're poor it, but it can be a problem that we are not… that we are not acknowledging. So I think it's important to spread the word out.” (Com1)
Weather events and changes contribute to CA	12	1.73%	“(…) they're having prolonged rains and also the volume of water compared to what they used to know in the past is phenomenal now and generating flooding and causing mayhem. The flooding has been able to inundate their farmlands, they've lost properties and so forth… So that alone has generated a lot of anxiety. And that’s what we are really calling climate anxiety” (KAY)

Theme / Code	Count	Coverage	Example Quote
Scale may be useful cross-culturally	10	1.44%	"And we know that a lot of these experiences that are in in these items I think are fairly universal, you know, people feeling overwhelmed, people feeling angry, people not knowing how to kind of like what actions to take, etcetera. So that sort of level, that uncertainty, so there's nothing about the items necessarily that surprised me, but it is just yeah, one of the key things for me is that cross-cultural relevance of these kinds of scales." (Res1)
Acknowledging religion and spirituality in CA	9	1.30%	"A lot of people feel more of a sort of spiritual connection to the natural world, for example, and that there's something around the loss of that, or the disruption to that, that feels that feels missing." (JOG)
CA stems from practical concerns	9	1.30%	"What you have is that you have excess, extreme heat, and the heat is increasing because of rising temperatures. And now it's affecting them, you know, sweating, excess perspiration... crops are not doing well. Now, you find anxiety as a result of crops not doing well. And the fear that they would run into famine, for instance, and that generates anxiety." (KAY)
Cut-off from nature	9	1.30%	"So I might ask in my assessments about what people's relationship to the natural world is and, and they will act as if they have no relationship whatsoever to the natural world in any shape or form." (JOG)
How to adapt the scale to other cultures	9	1.30%	"As a Māori person, I can say that my ontology does differ quite substantially to that of my colleagues, not in every way, but in some ways. And I just think being able to capture that and or at least honour it by having Māori work with you, or work with any researcher on the development of something is really important." (NTM)
Practical concerns take precedence	8	1.15%	"(...) here in Colombia to suffer or (be affected) by climate anxiety, it's a privilege. We have a lot of other things going on." (Com1)
Special considerations for direct experience	8	1.15%	"Climate change anxiety coming from someone's personal... experience of a climate related disaster where it's, you know, a bushfire or flood, or... or all the other ones... That's so different to someone who's worried about the future impact on their children (...)" (CP)

Theme / Code	Count	Coverage	Example Quote
Some impacts are culture-specific	7	1.01%	“because of that genealogical connection, there's a sense of, I guess... non-separation between the natural environment and ourselves. What happens to their natural environment sort of happens to us. So when we have these current circumstances where there tends to be a lack of what appears to be sustainability of the environment and degradation of the environment, then it has maybe a spiritual, emotional, psychological impact on a lot of Māori.” (NTM)
Attachment to land as risk factor	4	0.58%	“So you would have seen that quite a few marae were physically impacted by the fact that their marae was flooded. And that creates a sense of concern about connection to land and connection to place.” (NTM)
Climate Anxiety is Heterogenous	143	20.60%	
CA is a lot of different emotions	30	4.32%	“So I think it encompasses, for me, guilt, sorrow, anxiety, distress. All of these different, different emotions come under that banner for me. I don't think of it simply as, as the feelings of anxiety that we might think is, for me, more of a catch all term for lots of different climate emotions.” (JOG)
Bearing difficult feelings	20	2.88%	“I initially was calling it climate anxiety, but then I shifted, because what I find is that people will present feeling really anxious, but underneath that is often thoughts or feelings that they struggle to contain or experience, and often these are really big thoughts or feelings around grief or despair, or terror or rage.” (Clin2)
Taking action	19	2.74%	“And you know, they're taking real action kind of and often are extremely involved in many aspects of their lives and in climate action. And it's not the best thing for your wellbeing either.” (Res1)
CA is a lot of different behavioural changes	14	2.02%	“And behaviourally they might... engage in an excessive amount of activity for a while. For example, going to a lot of... climate related events or protests or where here in the field, they might become compulsive... or there might be the opposite, avoidance and shutdown.” (Res4)

Theme / Code	Count	Coverage	Example Quote
CA involves existential concerns	12	1.73%	"'I've had one client say to me "ohh what's the point", you know, like (...) The world is gonna burn anyways, so what's the point?" (Clin1)
Scale should be holistic	10	1.44%	"I think it tried to cover a lot of ground which I think is good, going back to my initial sort of response to what I think it is like, it's a range of- because I remember you talked about like people feeling angry or overwhelmed etcetera, so there's lots of different aspects like emotional components to it, which I think is an important thing to consider." (Res1)
Concern about future	9	1.30%	"And it's certainly came out in a lot of the people we spoke to, particularly older Māori, this anxiety around "well, how do we- what are we doing?". What is the world gonna be like for our grandchildren and great grandchildren and the state of- with our current environmental state and no apparent end or solutions to create a more sustainable way of living?" (NTM)
CA and eco-paralysis	8	1.15%	"(...) we think that sometimes having that urgency messages... for the common people, it does not make people act, but to get scared" (Com1)
Concerned about various global issues	8	1.15%	"Yeah, people do often talk to me about, you know, climate change in relation to other problems in the world. These people who get... disturbed by wars and the rise of fascism. I see those of all fairly linked on a sort of... similar continuum." (HIP1)
CA is a lot of different cognitive issues	6	0.86%	"And that fact that they are unable to explain what is happening and looking for answers to those questions generate some intrinsic anxiety." (KAY)
Lack of agency leads to worse outcomes	5	0.72%	"I see a lot of despair first. That empowerment, there's more empowerment with anger and grief in a way. But there's just empowerment- people feel... Actually, it's true of anything, if you've suffered and you didn't have any power during the experience of suffering, it's harder to deal with, that's... basic psychological research there, right?" (HIP1)

Theme / Code	Count	Coverage	Example Quote
Mild items are not useful in clinical context	2	0.29%	“I noticed that on the scale there are items that refer to, you know, terror, panic, cannot stop thinking about- like that really indicate high distress, and then other ones like “I worry sometimes” or “sometimes I think about this” or “I perceive other people”. I don't think people would seek out climate aware therapy from worrying sometimes.” (Clin2)
The Spectrum of Climate Anxiety	139	17.58%	
CA impairs functioning and wellbeing	34	4.90%	“But also there are people that have quite high intense levels of climate anxiety where... it might bring really impacting on their daily functioning, on their ability to study, on their ability to work, or hang out with their friends or family.” (CP)
CA occurs in a spectrum	18	2.59%	“I do think it's a rational reaction. But just like any disorder that we have, everything occurs on a spectrum, right? (...) you've got people who are in the normal range of anxiety. And then you've got the outliers, and they're quite impacted by this.” (Res2)
CA is not a disorder	16	2.31%	“I personally see it as quite an understandable reaction to a lived reality. I wouldn't see it as pathology at all. I see it as something that's actually quite useful.” (JOG)
CA is distinct from other disorders	15	2.16%	“What I'm seeing in my datasets and seeing in other places as well is that it has some comorbidity, but it's the kind of differentiation that you'd want. So it's similar, but it's not the same.” (Res2)
CA can have good outcomes	14	2.02%	“(...) adding in some things around- and maybe it was because I've just written some work in this space around some of the emotions are positive around climate change- like climate change anxiety isn't... sometimes can lead to positive emotions. Something- or positive behaviours, pro-environmental behaviours.” (CP)
Insufficient justification for	13	1.87%	“Generally speaking, what we qualify as a disorder and part of that is a specific presentation of something that yes, it causes social, educational, occupational impairment. That it's not better accounted for by something else, yadda yadda, so that would be what I would be looking for. That it kind of fulfils those

Theme / Code	Count	Coverage	Example Quote
non-disorder status			criteria and… I mean, I'm not saying that it should be a disorder, but I'm just- I question the justifications for saying that it's not, at this point." (Res2)
CA can overlap with domain-free disorders	9	1.30%	"Definitely that can coexist, absolutely. So someone with climate anxiety can be experiencing generalised anxiety or a form of depression. Or their climate anxiety might come, as I said, from that direct experience of a traumatic event, so they've got that PTSD-type syndrome and also then the climate anxiety related to that." (CP)
Tragic outcomes of CA	3	0.43%	"I had one young man who presented and he, he had actually been involved with the crisis team and had become quite suicidal. So it's not uncommon, I think. I've got a colleague in a rural area who's- there's actually been some young people have completed suicide as a result of their concerns about what's happening on the planet and the fact it's human induced as well." (Clin3)
Climate Anxiety can be in the Background	120	15.42%	
CA can be in the background	28	4.03%	"In fact, we came to terms to say there is, there is a mental health epidemic right now on the continent. We came to that conclusion in one of the seminars we had, that there is a subtle mental health epidemic. Because sometimes in epidemiology, epidemic is what we can see. But mental health is not what you can see. But then people live silently with it." (KAY)
Need for more training and education	14	2.02%	"I think, generally not very (confident) because I haven't received any formal training in it, like where I did my degree, there was no mention in it of climate distress at all. Uhm… and so I've done some follow-up trainings which have been really helpful and that's growing confidence" (Clin2)
Personal CA as instigator	12	1.73%	"But I think, like many people, moving to Australia from relatively stable climates that I had grown up in and lived in and then moving here and then within the first few years having been exposed to floods, droughts… We had bushfire season in 2019-2020. Yeah, just started thinking more about- I'm reading a lot about

Theme / Code	Count	Coverage	Example Quote
			particularly the Pacific Islands and how they are being affected by rising sea levels and things like that. Got interested in… how that could be affecting people's mental health (…)" (Res2)
Scale can help becoming aware of CA feelings	12	1.73%	"This is what the questionnaire does for me. So it probes into you, it presumes that you are unable to talk. And it makes you to talk. (…) You have certain inner most changes in you, and something you are not even aware of these changes that are occurring in you, they are affecting you but you are insensitive to it. So I would say the questionnaire is very sensitive (…)" (KAY)
Bottom-up understanding of CA	11	1.59%	"I think that there needs to be more, and I know that it's being done currently as well, kind of codesigned stuff like with… research teams that actually letting the people inform them rather than saying how it is or how they assume it might be." (Res4)
Peer support from professionals	10	1.44%	"But I'm lucky and being part of the CPA that there is a peer group of other eco-therapists and other professionals, not necessarily therapists. But who are interested in the psychology of climate change and who can uh… can meet regularly to express what we're feeling and explore different, different things that we're doing with clients and what helps and what doesn't. And so having that support I think is valuable." (JOG)
Psychologists need to be climate aware	10	1.44%	"I started doing a lot of reading and trying to figure out my own feelings and after about six months or a year of that, I realised that I couldn't separate my own journey from my work. I noticed that when I started tuning into my own anxiety or despair or rage, I would start hearing it and the people that I was working with, even if people weren't naming it as such." (Clin2)
CA is not very prevalent	6	0.86%	"Yeah, probably like three or four that I've talked to about it? So it's kind of a small percent, but I think probably once you explore things with people in more detail, it probably is a bit more prevalent than that." (Clin1)
Mild items are useful	4	0.58%	"I was going to say I think that the more mildly-worded ones are really useful for people who don't identify as having climate distress, but could do this and be like "oh, actually there is a bunch of things on here that aren't as obvious as I'm no longer functioning in my life. But yeah, I do feel guilty sometimes" or "I do notice that I'm reading lots of information", so it could be an awareness raiser?" (Clin2)

Theme / Code	Count	Coverage	Example Quote
Streamlining Measurement	63	9.09%	
Need for convergence and clarity in the literature	18	2.59%	"(...) the more work we get around conceptualization, the easier it should get down the track, but at the moment there's so many different terms and so many different approaches. But I think we're at a point where the research is coming together a bit more." (CP)
Current scales could be improved	11	1.59%	"I don't think any of the measures that are being created so far- I don't know about the Hogg one because I haven't used it, but certainly the climate change anxiety scale, I don't think has nearly enough sensitivity (...) or even specificity." (Res4)
Interviews are richer	9	1.30%	"And so we were starting to think about, like, how do we understand this... more deeply. How do we really capture the richness of that experience? And so we were leaning more towards like we need to venture more into the qualitative domain of just speaking to people, you know." (Res1)
Scale can be used in multiple contexts if it's good	7	1.01%	"(...) we as mental health professionals and researchers need both, so if it could work for both, incredible. (...) but as a researcher and clinician I'm like yes, let's work on this." (CP)
Top-down conceptualizations of CA	7	1.01%	"I definitely think... a strong consensus is needed... on what it is, what we're interested in, why we care, why we want- how we want to work with it, and why we wanna work with it. (...) And to do that there needs to be like a theoretically sound model perhaps or... construct. That can then be empirically tested and evaluated." (Res4)
Using scale for population research	7	1.01%	"And there is there is a degree to which these scales are helpful because you can capture- Certain experiences that we know are shared, maybe not universal, but there are certain elements of the experience that we know are shared and you can ask a lot of people at the same time." (Res1)

Theme / Code	Count	Coverage	Example Quote
A scale is useful if it's valid and reliable	4	0.58%	"I argued that because this is just statistically sound, it's much better than making up your own one, which wouldn't be." (HIP1)
Climate Anxiety is a Social Justice Issue	22	3.17%	
Young people feel angrier and impacted directly	11	1.59%	"Younger Māori are more politicised about it. So perhaps more anxious about it, more angry about it, but also more willing to do something about it." (NTM)
CA is a social justice issue	8	1.15%	"I think that... some of what... statements at the moment are lacking is the connection to wider systemic injustices which are connected very much with what's happening to the world. Uhm... And... I think I'd be a bit wary of (styling) climate change as if it's something that's just happening in a little bubble (...) part of what a lot of the petrochemical companies are trying to do is to individualise it. So I would resist that if you can." (JOG)
Not political instrument	3	0.43%	"For me as a practitioner, I'm not here to raise awareness of that, that's a political task. (...) And undermines the sort of principles around the person having agency about what they're coming to see me about." (HIP1)
(Other codes)			
Scale and intervention should be tailored	17	2.45%	"(...) because they've presented with eco-anxiety or climate anxiety that it's gonna look a particular way, you actually have to- just like any good psychological assessment, you have to tailor the intervention to the person's... issues and presenting symptoms and so you need to do a good assessment to discover what they are." (Clin3)

Theme / Code	Count	Coverage	Example Quote
Scale should be short and easy	12	1.73%	"You simplify the language, you know, and make the sentences much shorter. And obviously not 50 questions." (HIP1)
Things clinicians look for	12	1.73%	"Because I'm a CBT trained psychologist, I would assess using CBT principles, so I'd be looking at… their thoughts, their behaviours, their emotions… What happens when you read a piece of bad news about the climate? You know, how do you feel? What emotions? What thoughts go through your mind? How does your body respond physiologically? You know, what do you actually do or not do?" (Clin3)
Scale can be used as guide to formulation	11	1.59%	"You kind of need to begin with the end in mind. So if you're thinking about what is the scale going to inform, like a lot of these questions are really relevant and they're gonna tell us something. But is that then something that can be therapeutically worked with?" (Res4)
Using scale for monitoring	3	0.43%	"In clinical practise, how you want to use it is that it needs to be treatment sensitive. It needs to measure change as a result of treatment. So, is the person getting better? (…) Yeah, monitoring, so you know progress and outcome." (Clin3)
Scale should not be a monitoring tool	2	0.29%	"Yes, so there it would really depend… Because, in therapy the way we usually work is we work collaboratively with the client on their, on their goal." (Clin1)

Supplementary Table E11

Descriptive Statistics of Item's Relevance Ratings in Study 2

Item	N	Median	Mean	Aiken Index
1. It makes me angry that many people fail to do even the most basic things to protect the environment.	31	4	3.87	70.97
2. I feel uneasy when I think about the consequences of climate change.	31	4	4.13	77.42
3. People look at me in a strange way, because I am so passionate about environmental action.	31	3	3.26	41.94
4. I find it terrifying that the seasons have changed a lot in a short time.	31	4	3.81	70.97
5. I am constantly on alert because there could be a climate change related disaster at any time.	31	4	3.90	64.52
6. I worry about climate change more than other people.	31	4	4.00	70.97
7. I tend to seek out information about climate change in the media (e.g., TV, newspapers, internet).	31	4	3.97	70.97
8. I tend to worry when I hear about climate change, even when the effects of climate change may be some time away.	31	4	3.87	77.42
9. I worry about climate change so much that I feel paralyzed in being able to do anything about it.	31	5	4.06	74.19
10. I notice that I have been worrying about climate change.	31	5	4.26	77.42
11. I worry about how climate change may affect the people I care about.	31	5	4.35	83.87
12. I blame myself for often behaving in an environmentally destructive way in situations where it could have been avoided.	31	4	3.39	51.61
13. I experience some guilt over the fact that my family and friends' lifestyles and consumption patterns are in part responsible for the unfolding impacts of climate change.	31	4	3.87	64.52
14. I often feel like a hypocrite when it comes to environmental action.	31	4	3.61	51.61
15. The more I know about the human causes of climate change, the more things I feel guilty about.	31	4	3.84	61.29

Item	N	Median	Mean	Aiken Index
16. It makes me feel uneasy that I am part of a system that is amplifying climate change.	31	4	4.03	80.65
17. It makes me sad that I don't see many of the plants and animals I used to see often.	31	4	3.61	58.06
18. It is frightening that climate change is causing the destruction of natural areas at such a dramatic rate that they will never be the same again.	31	4	4.06	80.65
19. I feel afraid of climate change and other global environmental problems.	31	5	4.48	83.87
20. I am unable to stop thinking about future climate change and other global environmental problems.	31	5	4.42	83.87
21. I am unable to stop thinking about past events related to climate change.	31	4	3.45	51.61
22. I am unable to stop thinking about losses to the environment.	31	4	4.10	83.87
23. I feel anxious about the impact of my personal behaviours on the earth.	31	4	4.03	70.97
24. I have problems balancing my concerns about sustainability with the needs of my family.	31	4	3.71	67.74
25. I feel angry when I see how little is done to combat climate change.	31	4	4.19	80.65
26. I am enraged that we have missed many chances to stop climate change.	31	4	4.00	77.42
27. News about climate change makes me feel depressed.	31	4	4.10	77.42
28. The uncertainty about how climate change will progress scares me.	31	5	4.26	77.42
29. I am scared that people will lose their homes because of climate change.	31	4	3.90	70.97
30. The impact that climate change has had on the planet saddens me.	31	4	4.19	80.65
31. Climate change drains all my energy.	31	4	3.87	70.97
32. Because of climate change, I am overwhelmed by everyday activities.	31	4	3.81	67.74
33. I am overwhelmed by the awareness of the approaching climate disaster.	31	5	4.23	77.42
34. Everything seems uncertain because of climate change.	31	5	4.35	80.65

Item	N	Median	Mean	Aiken Index
35. I feel outraged at corporations that harm the climate.	31	4	4.26	80.65
36. The increasing public engagement with climate change gives me hope.	31	4	4.06	74.19
37. Concrete actions for the climate allow me to be optimistic about the future.	31	4	3.84	64.52
38. I feel confused about what I can do to reduce climate change.	31	4	3.61	54.84
39. I feel helpless when I think of how difficult it is to live in a climate-friendly way.	31	4	4.29	87.10
40. It upsets me that I have a big negative impact on the climate.	31	4	3.52	58.06
41. I feel guilty that my lifestyle contributes to climate change.	31	4	3.87	61.29
42. I feel like one of the few people who actually understand what climate change entails.	31	4	3.52	51.61
43. I feel lonely because most of the people around me don't care about climate change as much as I do.	31	4	3.81	64.52
44. I feel lonely because it's difficult to talk about my climate change concerns with other people.	31	4	4.06	74.19
45. I feel sorry about the possibilities we are losing forever because of climate change.	31	4	3.90	70.97
46. I am overwhelmed by how many aspects of life would need to be changed to limit climate change.	8	5	4.50	75.00
47. I feel alienated because society considers concern for climate change as something strange.	8	4	3.75	75.00
48. The thought that the world I know is disappearing forever because of climate change makes me sad.	8	4	4.13	87.50

Supplementary Table E12

Sociodemographic Characteristics of Study 3's Participants

	n	%
Gender		
Female	163	47.80
Male	173	50.73
Non-binary	1	.29
Trans Woman	1	.29
No response	3	.88
Ethnicity		
Asian	9	2.64
Black/African American	7	2.05
Hispanic/Latino(a)	12	3.52
Indian	2	.59
Pacific Islander	1	.29
White	297	87.10
Mixed	6	1.76
No response	7	2.05
Country of residence		
Canada	2	.59
United Kingdom	6	1.76
United States	332	97.36
No response	1	.29
Political orientation		
Strongly conservative	84	24.63
Moderately conservative	47	13.78
Slightly conservative	32	9.38
Centre	33	9.68
Slightly liberal	36	10.56
Moderately liberal	54	15.84
Strongly liberal	54	15.84
No response	1	.29

	n	%
SASSY Group		
Alarmed	102	29.91
Cautious	50	14.66
Concerned	63	18.48
Dismissive	14	4.11
Doubtful	7	2.05
Not assigned	105	30.79

Kruskal-Wallis Tests

A Kruskal-Wallis test showed there were significant differences in WCARS scores between SASSY groups, $H(4) = 59.3$, $p < .001$, with Dwass-Steel-Critchlow-Fligner pairwise comparisons showing alarmed (median = 1.50) and concerned participants (median = 1.43) had significantly higher scores than cautious participants (median = .57, $p = .022$ and .008 respectively). The cautious group had significantly higher scores than doubtful (median = .00, $p = .004$) and dismissive (median = .00, $p < .001$) participants.

For the HEAS-13, there also were significant differences between SASSY groups, $H(4) = 35.0$, $p < .001$. Pairwise comparisons showed the concerned (median = .92) group scored highest, followed by the alarmed group (median = .46, $p = .687$) and the cautious group (median = .40, $p = .259$). Again, the doubtful (median = .00) and dismissive (median = .00) groups scored lower, though this difference was only significant for the dismissive group ($p = .006$, $p = .096$ for the doubtful group).

For the political orientation comparison, there were significant differences between groups for the WCARS, $H(2) = 22.13$, $p < .001$. The liberal group (median = 2.00) scored significantly higher than both the conservative (median = 1.43, $p < .001$) and centre (median = 1.00, $p < .001$) groups, which did not differ significantly between them (p = .705).

There were significant differences between political orientation groups for the HEAS-13, $H(2) = 8.58$, $p = .014$. The liberal group (median = 1.08) scored significantly higher than the centre group (median = .54, $p = .018$), but not the conservative group (median = .62, $p = .069$), which again did not differ significantly between them ($p = .620$).

Structural Model Testing Strategy in Study 3

To test the structural model, we used the item parcelling strategy for the WCARS and retained all WHO-5 items as manifest indicators. Because the HEAS-13 and the DASS-21 have predetermined multifactorial structures, we ran preliminary CFAs to assess whether these fit our data. Because SEMLj does not support ML estimation using ordinal data, robust WLSMV estimation was used for the CFA and SEM, which is more suitable for non-normal data (Brown, 2006). We report robust fit statistics when they are available and scaled fit statistics otherwise. Typical model fit cut-off values (CFI/TLI > .90; SRMR < .08; RMSEA < .06) were established assuming ML estimation. Therefore, we used these cut-offs only as guidelines. We found that the fit was acceptable in both cases and better in the predetermined factor structures for the HEAS-13 and the DASS-21 than the item parcelling strategy (see Supplementary Table E13).

Supplementary Table E13

Robust Model Fit Statistics for Measure's CFAs in Study 3

Scale	Scaled χ^2	df	CFI	TLI	SRMR	RMSEA [90% CI]
WCARS (single factor)	920	189	.864	.849	.053	.138 [.128; .148]
WCARS (two factors)	435	151	.946	.939	.034	.091 [.079; .103]
WCARS (bifactor)	394	169	.960	.951	.022	.079 [.067; .090]
WCARS5	13.32	5	.990	.980	.010	.096 [.035; .160]
HEAS-13 (four factors)	91.4	59	.983	.978	.015	.071 [.044; .095]
HEAS-13 (single factor)	304	65	.918	.901	.034	.149 [.130; .169]
HEAS-13 (second-order factor)	136.2	61	.974	.967	.021	.086 [.062; .109]
DASS-21 (three factors)	293	186	.954	.948	.025	.081 [.069; .094]
DASS-21 (single factor)	613	189	.882	.869	.044	.129 [.118; .141]
DASS-21 (second-order factor)	293	186	.954	.948	.025	.081 [.069; .094]
WHO-5 (single factor)	19.66	5	.985	.970	.015	.108 [.061; .159]
HEAS-18	197.8	125	.971	.964	.017	.076 [.060; .091]

Supplementary Table E14

Descriptive Statistics, Normality, and Correlations of Measures including DASS and HEAS-13 subscales in Study 3

Scale	*M (SD)*	Shapiro-Wilk	ω	1	2	3	4	5	6	7	8	9	10
1. WCARS	1.60 (1.09)	.94***	.97	-	.85***	.75***	.62***	.78***	.73***	.82***	.80***	.73***	.82***
2. HEAS-13	.95 (.85)	.89***	.97	.85***	-	.83***	.69***	.85***	.80***	.96***	.91***	.90***	.93***
3. DASS-21	1.01 (.84)	.91***	.97	.75***	.80***	-	.93***	.94***	.96***	.82***	.71***	.78***	.75***
4. Depression	.99 (.91)	.88***	.94	.63***	.68***	.94***	-	.77***	.84***	.70***	.56***	.69***	.61***
5. Anxiety	.96 (.89)	.88***	.94	.76***	.83***	.93***	.79***	-	.87***	.83***	.75***	.79***	.79***
6. Stress	1.09 (.88)	.92***	.94	.72***	.78***	.97***	.87***	.88***	-	.80***	.69***	.74***	.73***
7. Affective Symptoms	.94 (.93)	.87***	.92	.82***	.96***	.81***	.70***	.81***	.80***	-	.82***	.86***	.85***
8. Rumination	1.01 (.93)	.88***	.91	.81***	.91***	.69***	.57***	.75***	.68***	.82***	-	.74***	.84***
9. Behavioural Symptoms	.81 (.88)	.84***	.89	.73***	.91***	.76***	.68***	.78***	.74***	.87***	.76***	-	.76***
10. Anxiety about Personal Impacts	1.03 (.91)	.89***	.91	.82***	.93***	.75***	.63***	.78***	.73***	.86***	.84***	.78***	-

Note. ω = McDonald's omega. Spearman correlations are presented below the diagonal, and Pearson correlations above the diagonal

* $p < .05$. ** $p < .01$. ***$p < .001$.

Supplementary Table E15

Structural Equation Scaled Model Fit Statistics Predicting DASS-21 and WHO-5 in Study 3

Model	χ^2	df	CFI	TLI	SRMR	RMSEA [90% CI]
HEAS-13	123.2	58	.971	.967	.057	.061 [.046; .075]
WCARS5 + HEAS-13	246	120	.971	.967	.053	.059 [.048; .069]
HEAS-18	141	70	.966	.963	.057	.058 [.044; .072]

Supplementary Table E16

Structural Equation Scaled Model Fit Statistics Predicting DASS-21 Only in Study 3

Model	χ^2	df	CFI	TLI	SRMR	RMSEA [90% CI]
HEAS-13	113.18	13	.936 (1.000)	.897 (1.000)	.020 (.020)	.158 [.132; .186] (.031 [.026; .036])
WCARS + HEAS-13	175.1	32	.937 (.999)	.911 (.998)	.028 (.028)	.119 [.102; .136] (.039 [.033; .045])
WCARS5 + HEAS-13	57.50	58	1.000	1.000	.017 (.017)	.000 [.000; .035]
HEAS-18	129.19	19	.936 (.999)	.906 (.999)	.020 (.020)	.138 [.116; .161] (.027 [.023; .032]

Note. Robust fit measures are presented in parentheses when available

Supplementary Table E17

Exploratory Factor Analysis of WCARS Items

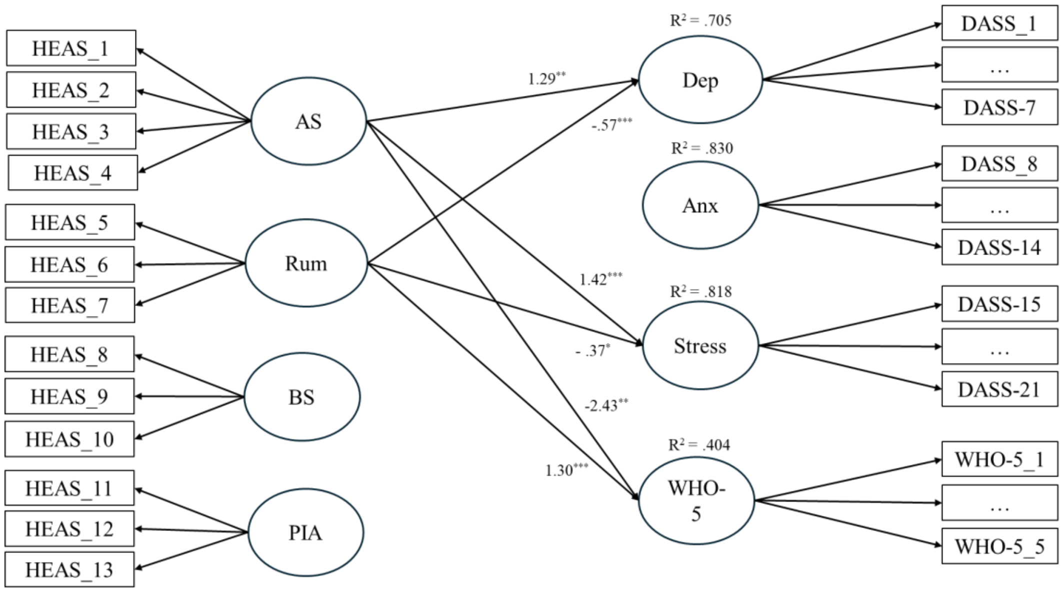
Item	Factor	
	1	2
4. I worry about how climate change may affect me and the people I care about.	.950	
6. I worry that climate change is destroying nature.	.935	
9. I feel angry when I see how little corporations and governments do to stop climate change.	.853	

Item	Factor	
	1	2
19. I feel sad because the world I know is disappearing forever due to climate change.	.843	
1. I feel uneasy when I think about climate change and other global environmental problems.	.800	
15. I feel like everything seems uncertain because of climate change.	.752	
10. I feel distressed when I see news about climate change.	.719	
16. I feel hopeless about our ability to fight climate change.	.688	
2. I feel terrified by the effects of climate change.	.671	
20. I think about the end of humankind because of climate change.	.671	
5. I feel uncomfortable or guilty that I am part of a system that may be amplifying climate change.	.602	
14. I feel overwhelmed by the consequences of climate change.	.575	.331
8. I have problems with my family, studies, or work because of my climate change concerns.		.979
11. I experience physical symptoms (e.g., headaches, nausea, shortness of breath, heart palpitations) when thinking about climate change.		.885
13. I feel restless or have difficulty sleeping because of climate change.		.856
12. I feel fatigued or have difficulty concentrating because of climate change.		.837
18. I feel lonely because it’s difficult to talk about my climate change concerns with other people.		.747
7. I am unable to stop thinking about climate change.		.613
21. I feel like everything is pointless because of climate change.	.324	.595
3. I can't stop seeking out information about climate change in the media (e.g., TV, newspapers, internet).		.576
17. I feel powerless or paralyzed when I think of how difficult it is to live in a climate-friendly way.		.539

Note. Factor loadings lower than .300 are not displayed. Factor 1 accounts for 40.1% of variance, and Factor 2 for 30.8%. The correlation between the two factors is r = .740.

Supplementary Figure E5

Latent Model Predicting Depression, Anxiety, Stress, and Life Satisfaction from HEAS-13 Subscales



Note. AS = Affective Symptoms; Rum = Rumination; BS = Behavioural Symptoms; PIA = Personal Impact Anxiety; Dep = Depression; Anx = Anxiety; WHO-5 = Wellbeing Index. Factor loadings excluded for clarity. Only significant paths are displayed. Values correspond to standardized effects. Model fit indices: Scaled χ^2 (674) = 628, p = .898; robust CFI = .913; robust TLI = .905; robust SRMR = .041; robust RMSEA = .086, p < .001; 90% CI [.078, .093].

* p < .05. ** p < .01. ***p < .001.

Appendix F: Supplementary Materials for Chapter 6

Supplementary Table F1

Additional Sociodemographic Characteristics of Participants

	n	%
Yearly income (NZD)		
Loss	2	.5
Zero Income	3	.7
1 – 10,000	12	2.8
10,001 – 15,000	5	1.2
15,001 – 20,000	14	3.3
20,001 – 25,000	15	3.5
25,001 – 30,000	13	3.0
30,001 – 35,000	17	4.0
35,001 – 40,000	14	3.3
40,001 – 50,000	32	7.5
50,001 – 60,000	29	6.8
60,001 – 70,000	24	5.6
70,001 – 100,000	74	17.2
100,000 – 150,000	94	21.9
150,001 – 200,000	55	12.8
200,001 or More	26	6.1
No Response	0	0
Type of Environment		
Rural/Village Residence	41	9.6
Small or Midsized Town	107	25.2
Urban/City Residence	277	65.2
No Response	4	.9
Political orientation		
Strongly conservative	12	2.8
Moderately conservative	39	9.1
Slightly conservative	51	11.9
Centre	179	41.7
Slightly liberal	47	11.0

	n	%
Moderately liberal	64	14.9
Strongly liberal	37	8.6
No response	0	0
Environment-based Occupation		
No	380	89.2
Yes	56	10.8
No Response	3	.7
Mental health Diagnosis		
No	373	86.9
Yes	56	13.1
No Response	0	0
Preparedness for Climate Change		
Strongly Disagree	28	6.5
Slightly Disagree	72	16.8
Neither Agree nor Disagree	152	35.4
Slightly Agree	140	32.6
Strongly Agree	37	8.6
No Response	0	0
Direct Experience with Climate Change		
No	282	65.7
Yes	147	34.3
No Response	0	0

Supplementary Text F1

Exclusion Criteria

We employed multiple safeguards to ensure data quality. Participants were excluded if their responses were flagged by Qualtrics as bot (reCaptcha score of .5 or higher), or duplicate responses (RelevantIDDuplicateScore of 75 or higher, or RelevantIDFraudScore of 30 or higher). We further excluded participants who completed the entire questionnaire in 120 seconds or less (Wood et al., 2017), and those who failed more than one of our three attention check items (e.g., "During the last 30 days, about how often did you drink cement?").

Supplementary Table F2

Confirmatory Factor Analysis of the Measures Considered in the Study

Scale	*df*	χ^2	CFI	TLI	SRMR	RMSEA [90% CI]
AS	2	.495	1.000	1.000	.003	.000 [.000, .063]
Rum	3	.000	1.000	1.000	.000	.000 [.000, .000]
BS	3	.000	1.000	1.000	.000	.000 [.000, .000]
PIA	3	.000	1.000	1.000	.003	.000 [.000, .063]
HCAS [a]	59	75.128	.998	.998	.024	.025 [.000, .041]
HCAS + WCARS [b]	130	239.855***	.990	.988	.041	.044 [.036, .053]
K10	35	229.251***	.980	.974	.033	.114*** [.100, .128]
K10 [c]	34	167.390***	.986	.982	.027	.096*** [.082; .111]
WHO-5	5	36.276***	.996	.991	.014	.122** [.086, .160]
WHO-5 [d]	4	16.513**	.998	.996	.009	.086 [.046; .131]

Note. AS = Affective Symptoms; Rum = Rumination; BS = Behavioural Symptoms; PIA = Personal Impact Anxiety; HCAS = Hogg Climate Anxiety Scale; K10 = Kessler Distress Scale; WHO-5 = Wellbeing Index.

[a] Higher-order latent factor predicted from the four HCAS dimensions.

[b] HCAS + WCARS corresponds to the higher-order latent factor predicted from the four HCAS dimensions and the five items from the Waikato Climate Anxiety Rasch Scale.

[c] Including residual correlation between item 5 ("About how often did you feel restless or fidgety?") and 6 ("About how often did you feel so restless you could not sit still?").

[d] Including residual correlation between item 3 (“I have felt active and vigorous”) and 4 (“I woke up feeling fresh and rested”).

[*] $p < .05$. [**] $p < .01$. [***] $p < .001$.

Supplementary Table F3

Descriptive Statistics of Scale Scores

Scale	*N*	Possible Range	*M (SD)*	Komolgorov-Smirnov	α	*ω*
HCAS Total	417	0 – 3	.369 (.513)	.236***	.929	.929
Affective Symptoms	417	0 – 3	.426 (.649)	.303***	.881	.890
Rumination	417	0 – 3	.300 (.543)	.381***	.862	.882
Behavioural Symptoms	417	0 – 3	.423 (.628)	.273***	.746	.752
Personal Impact Anxiety	417	0 – 3	.306 (.521)	.370***	.821	.823
K10	411	0 – 40	9.430 (8.699)	.139***	.948	.948
WHO-5	413	0 – 4	2.592 (1.179)	.086***	.917	.917
PEBQ	413	0 – 1	.230 (.154)	.098***	.668	.678

Note. Data weighted by ethnicity. HCAS = Hogg Climate Anxiety Scale; K10 = Kessler Distress Scale; WHO-5 = Wellbeing Index; PEBQ = Pro-Environmental Behaviour Questionnaire; α = Cronbach’s alpha; *ω* = McDonald’s omega. HCAS total obtained by calculating the mean of the 13 HCAS items

[*] $p < .05$. [**] $p < .01$. [***] $p < .001$.

Supplementary Table F4

Prevalence and Mean HCAS Scores by Region of New Zealand

	Prevalence		*M*	
	Estimate (%)	95% CI	Estimate	95% CI
Northland	0	[0; 20.0]	.210	[0; .428]
Auckland	6.6	[3.5; 11.4]	.446	[.360; .532]
Waikato	2.8	[.3; 12.3]	.326	[.157; .496]
Bay of Plenty	14.3	[5.0; 30.5]	.322	[.091; .554]
Gisborne	0	[0; 66.7]	.577	[0; 3]
Hawke's Bay	8.3	[.9; 32.8]	.397	[0; .914]
Taranaki	0	[0; 20.0]	.207	[0; .445]
Manawatū-Whanganui	0	[0; 13.5]	.163	[.055; .271]
Wellington	7.7	[2.7; 17.3]	.358	[.200; .516]
West Coast	0	[0; 53.6]	.417	[0; 1.669]
Canterbury	3.8	[.8; 11.8]	.271	[.155; .387]
Otago	0	[0; 10.7]	.405	[.226; .584]
Southland	0	[0; 26.2]	.620	[.144; 1.096]
Tasman	0	[0; 33.0]	.419	[.027; .812]
Nelson	0	[0; 37.9]	.297	[0; .892]

Note. HCAS = Hogg Climate Anxiety Scale. The Marlborough region was omitted because it had zero participants after weighting the data by ethnicity. Scores range from 0 (*Not at all)* to 3 (*Nearly every* day); HCAS total obtained by calculating the average of the 13 HCAS items.

Supplementary Table F5

Mean HCAS Dimension Scores by Region of New Zealand

	Affective Symptoms	Rumination	Behavioural Symptoms	Personal Impact Anxiety
Northland	.250	.091	.273	.212

	Affective Symptoms	Rumination	Behavioural Symptoms	Personal Impact Anxiety
Auckland	.519	.367	.502	.370
Waikato	.440	.231	.351	.245
Bay of Plenty	.445	.241	.314	.249
Gisborne	.500	1.000	.167	.667
Hawke's Bay	.431	.383	.352	.410
Taranaki	.243	.125	.261	.187
Manawatū-Whanganui	.250	.059	.235	.078
Wellington	.355	.387	.341	.349
West Coast	.527	.301	.401	.401
Canterbury	.330	.204	.333	.197
Otago	.493	.220	.491	.387
Southland	.135	.806	1.159	.543
Tasman	.484	.203	.867	.102
Nelson	.497	.083	.457	.083

Note. HCAS = Hogg Climate Anxiety Scale. Scores range from 0 (*Not at all)* to 3 (*Nearly every* day).

Supplementary Table F6

Bivariate correlations Between HCAS Scores and Sociodemographic Variables

	Coefficient	95% CI
Age [a]	-.253***	[-.341; -.161]
Male [b]	-.108*	[-.170; -.045]
Ethnicity		
NZ European / Other European [b]	-.048	[-.111; .016]
Māori [b]	.058	[-.005; .121]
Pasifika [b]	.061	[-.002; .124]

	Coefficient	95% CI
Asian [b]	-.027	[-.091; .036]
African / Latin American / Middle Eastern [b]	-.018	[-.081; .046]
Other NZ [b]	-.016	[-.079; .048]
Conservative Political Orientation [c]	-.133**	[-.228; -.035]
Income [c]	-.080	[-.177; .018]
Urban Residence [c]	.034	[-.065; .132]
Environmental Occupation [b]	.151***	[.089; .213]
Mental Health Diagnosis [b]	.132**	[.069; .194]
Adaptation [c]	-.203***	[-.296; -.107]
Personal Experience with Climate Change [b]	.216***	[.155; .276]

Note. HCAS = Hogg Climate Anxiety Scale.

[a] Pearson's *r*.

[b] Kendall's tau.

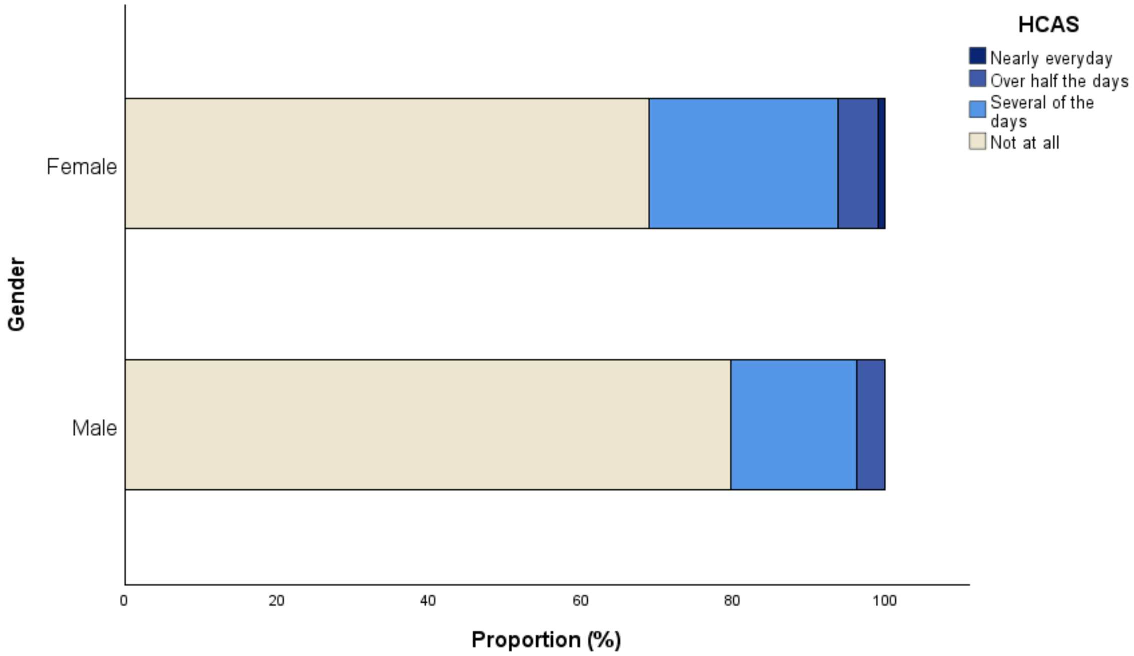
[c] Spearman's rho.

* $p < .05$. ** $p < .01$. *** $p < .001$.

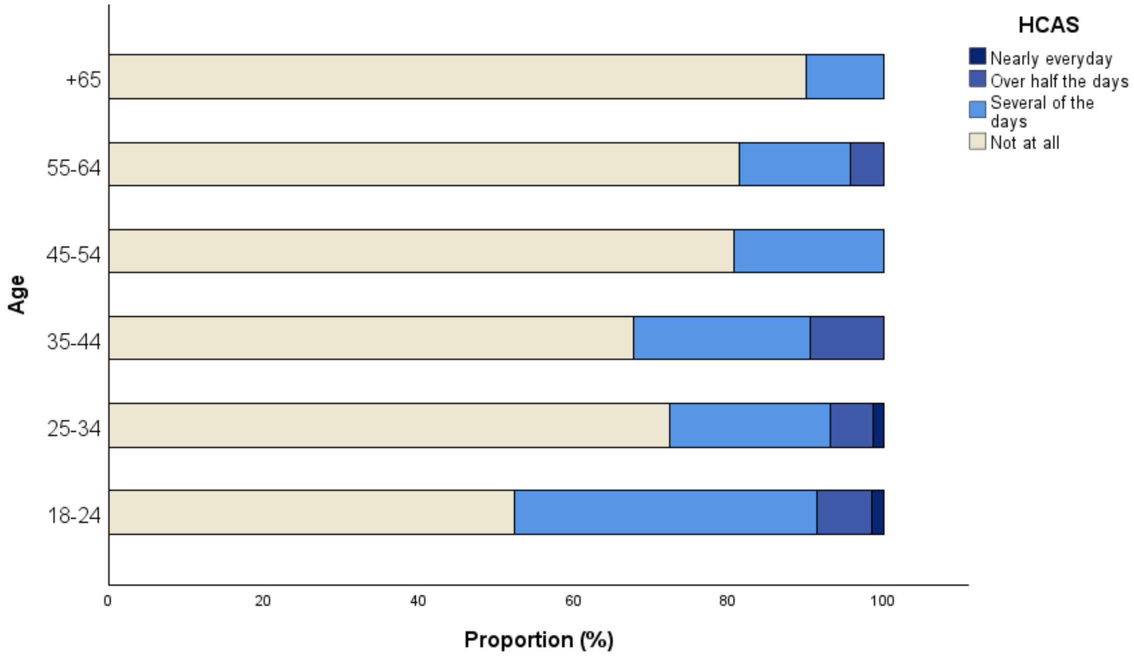
Supplementary Figure F1a-F1m

Prevalence of Climate Anxiety by Sociodemographic Characteristics

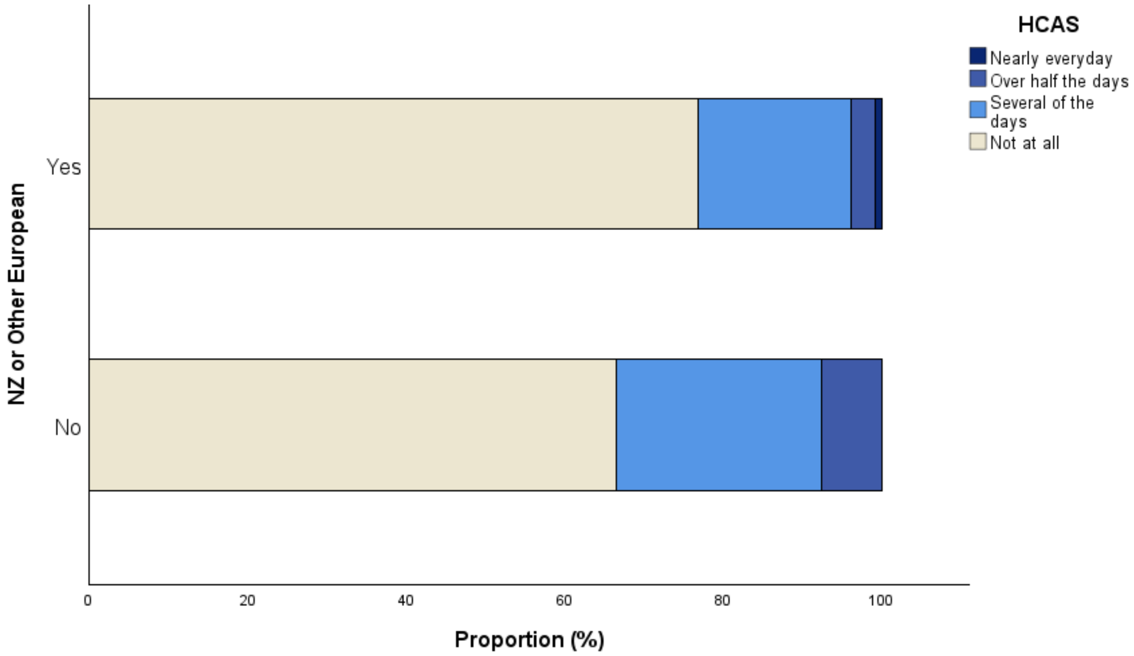
F1a - Gender



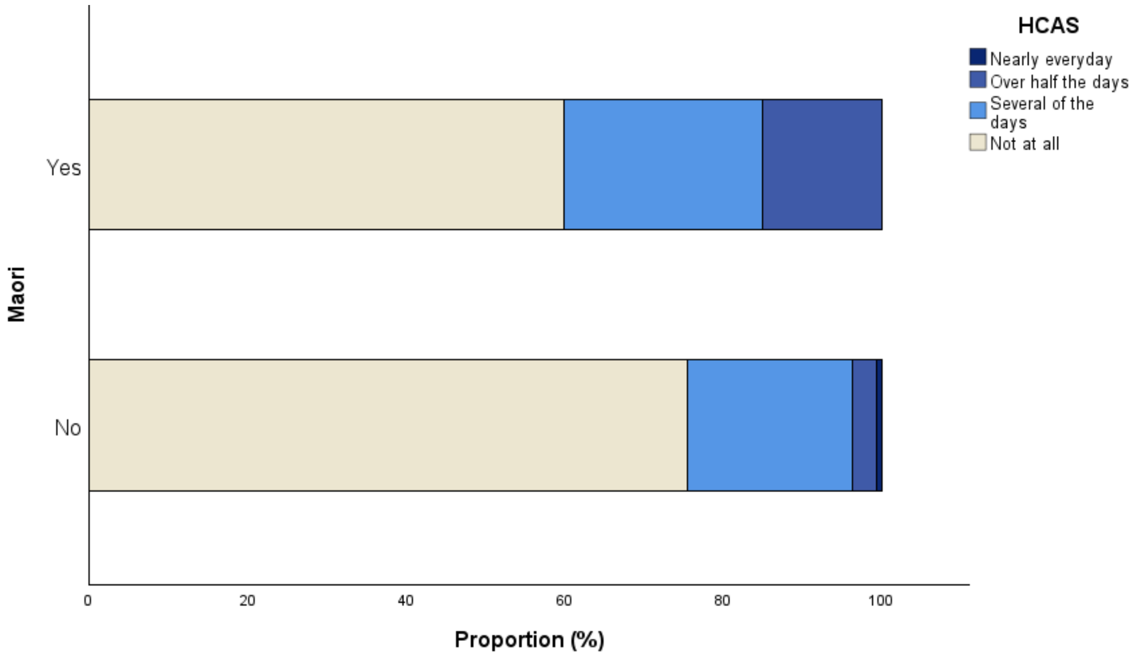
F1b - Age



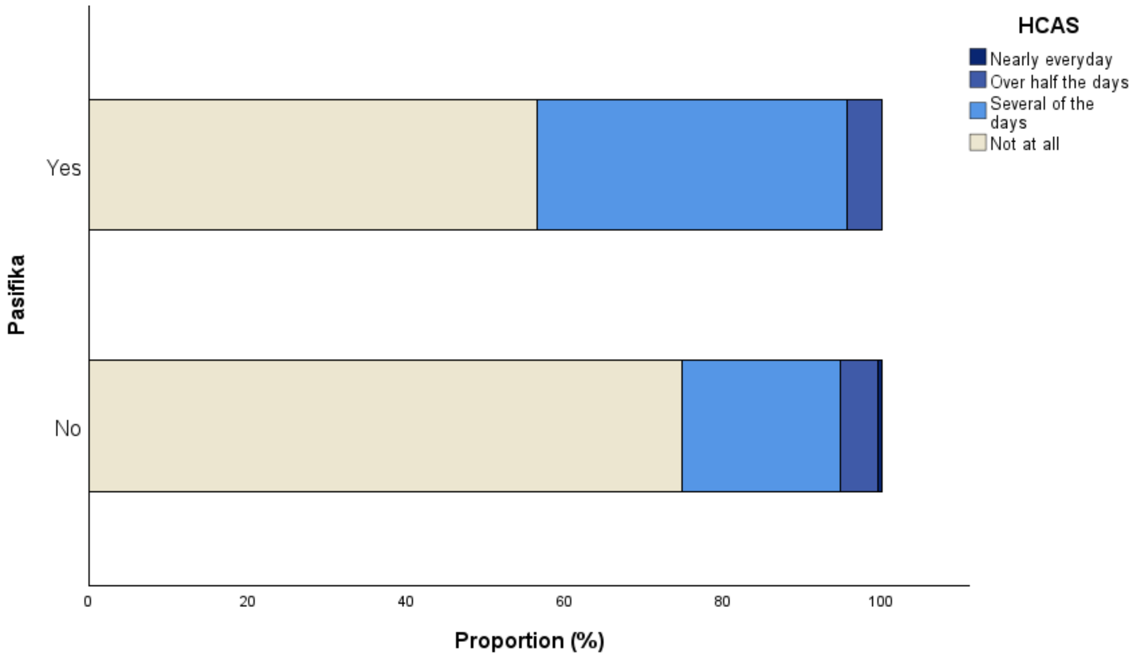
F1c – Ethnicity (New Zealand or Other European)



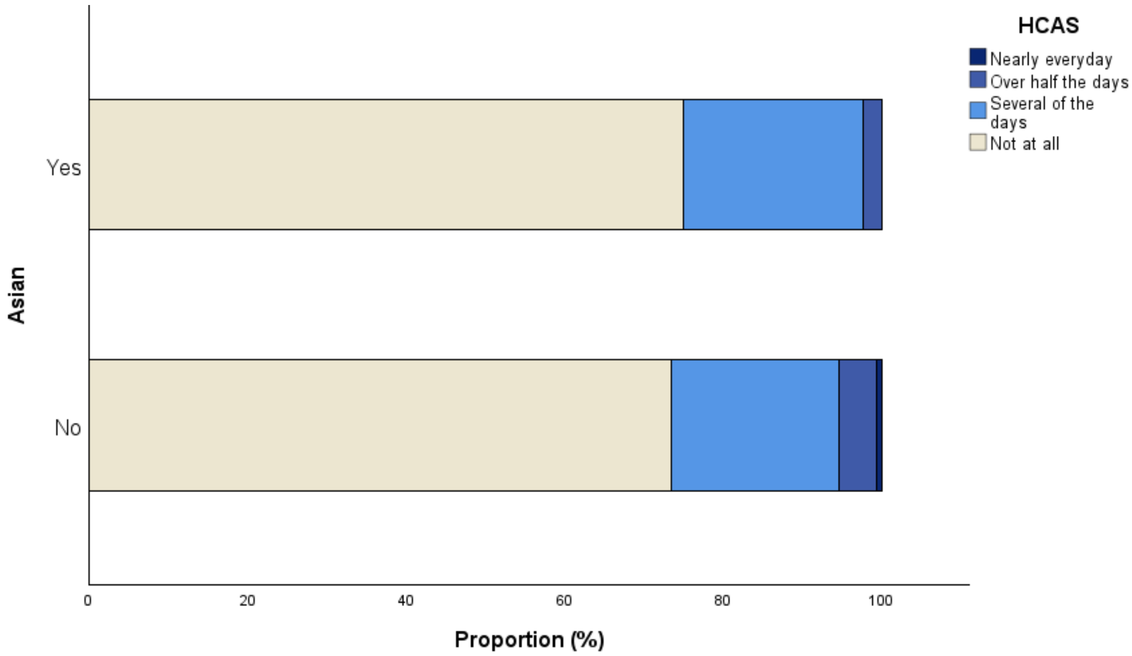
F1d – Ethnicity (Māori)



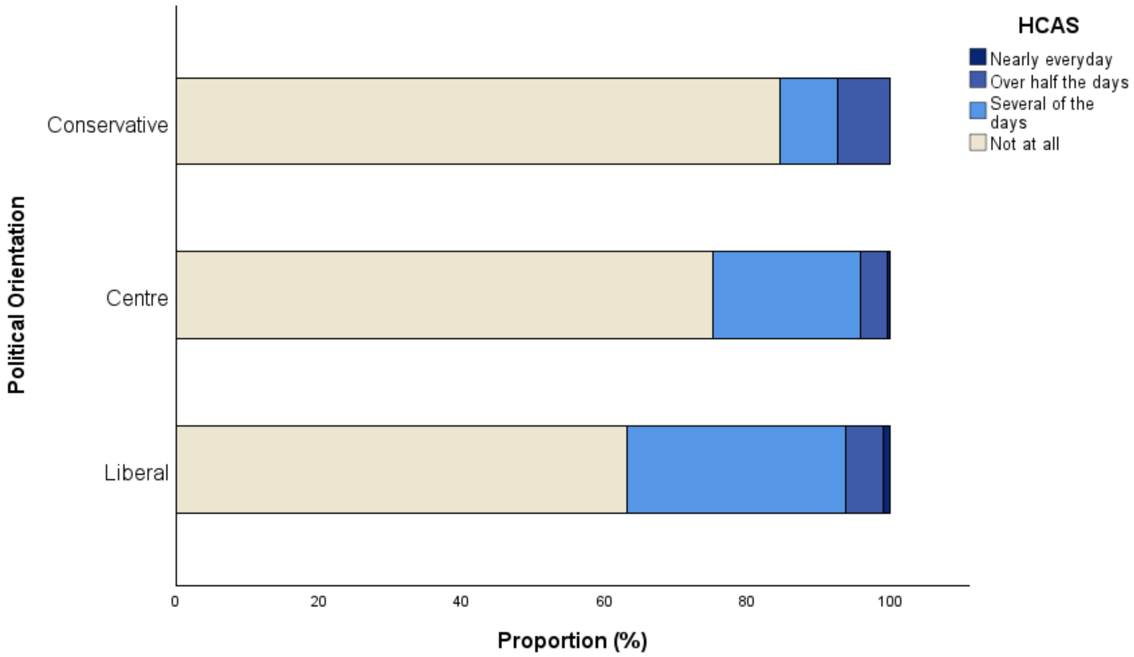
F1e – Ethnicity (Pasifika)



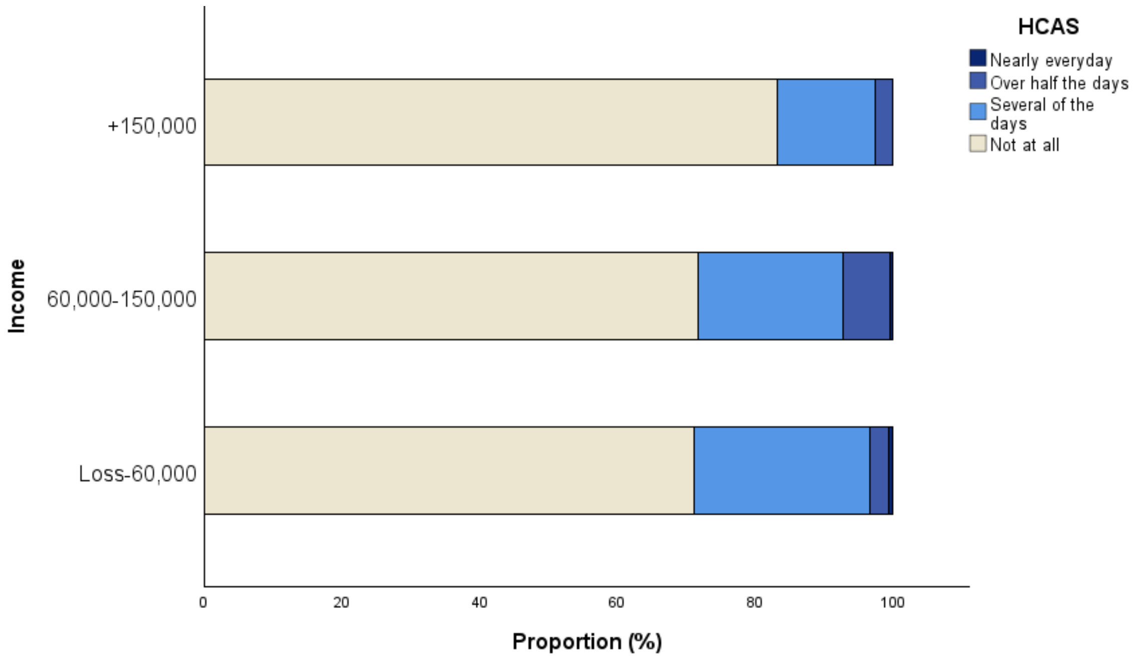
F1f – Ethnicity (Asian)



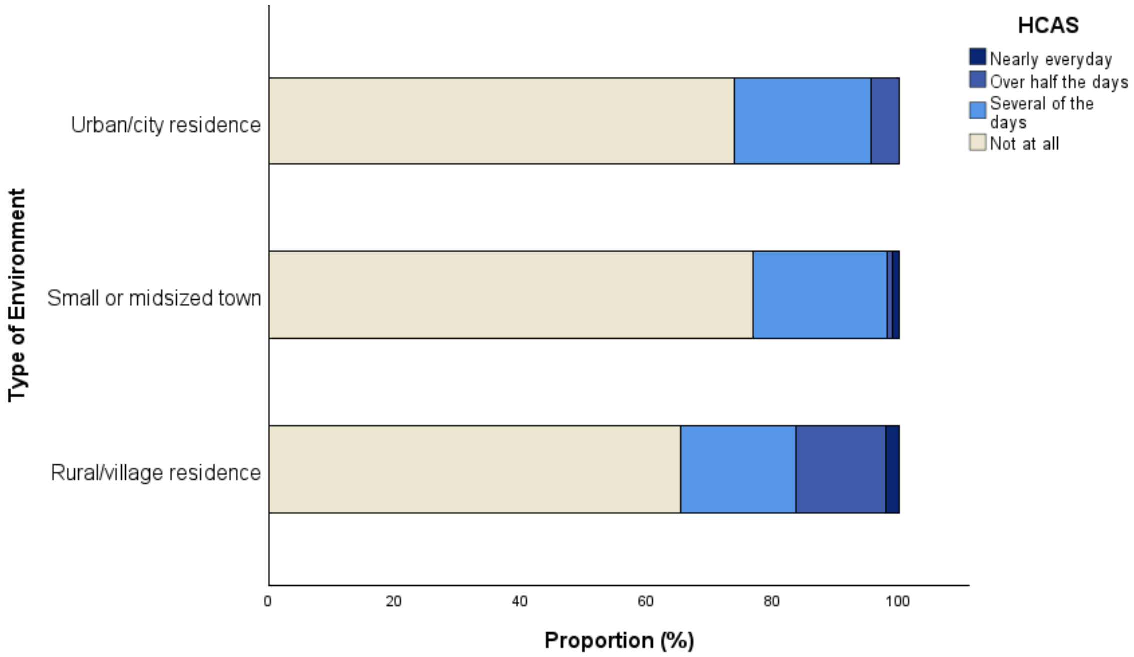
F1g – Political Orientation



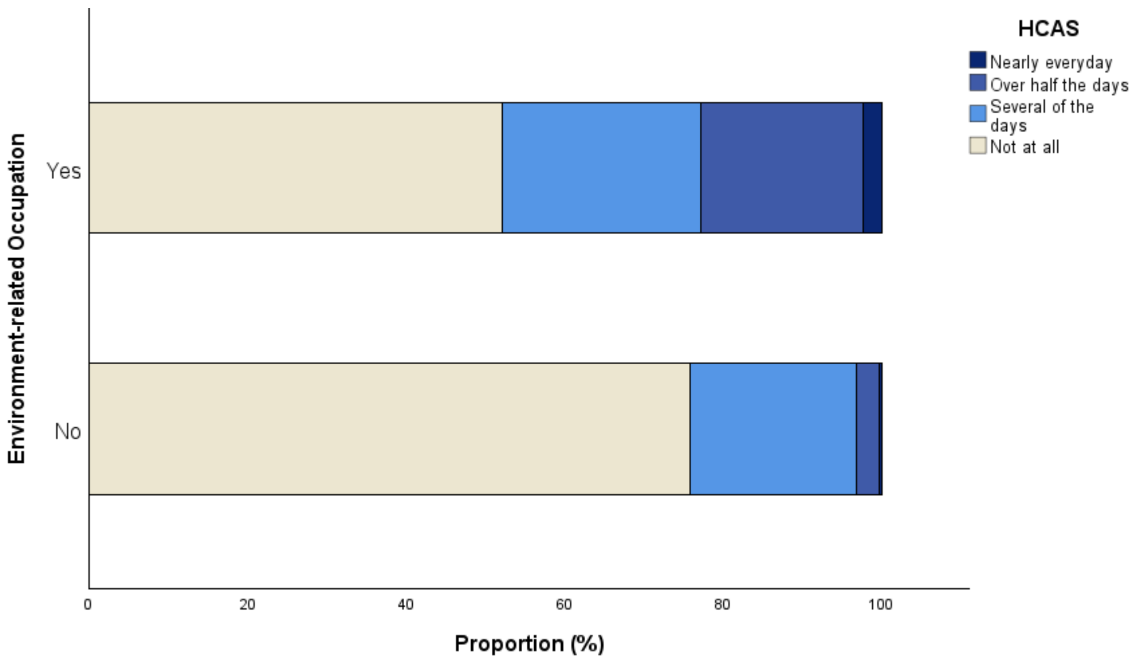
F1h - Income



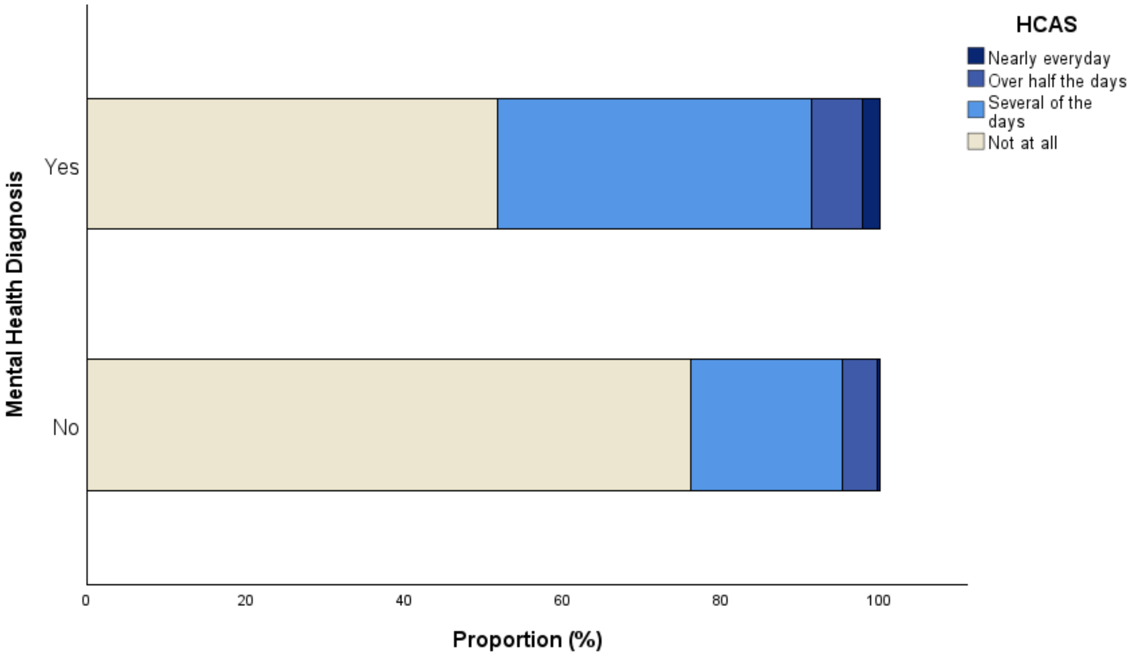
F1i – Type of Environment



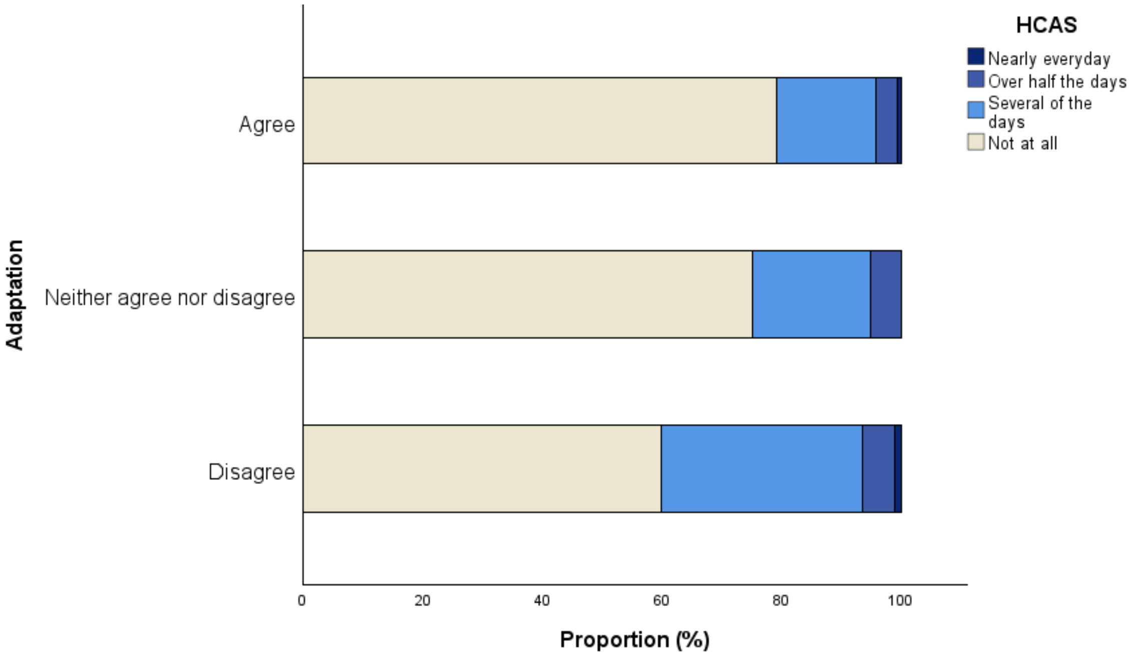
F1j – Environment-related Occupation



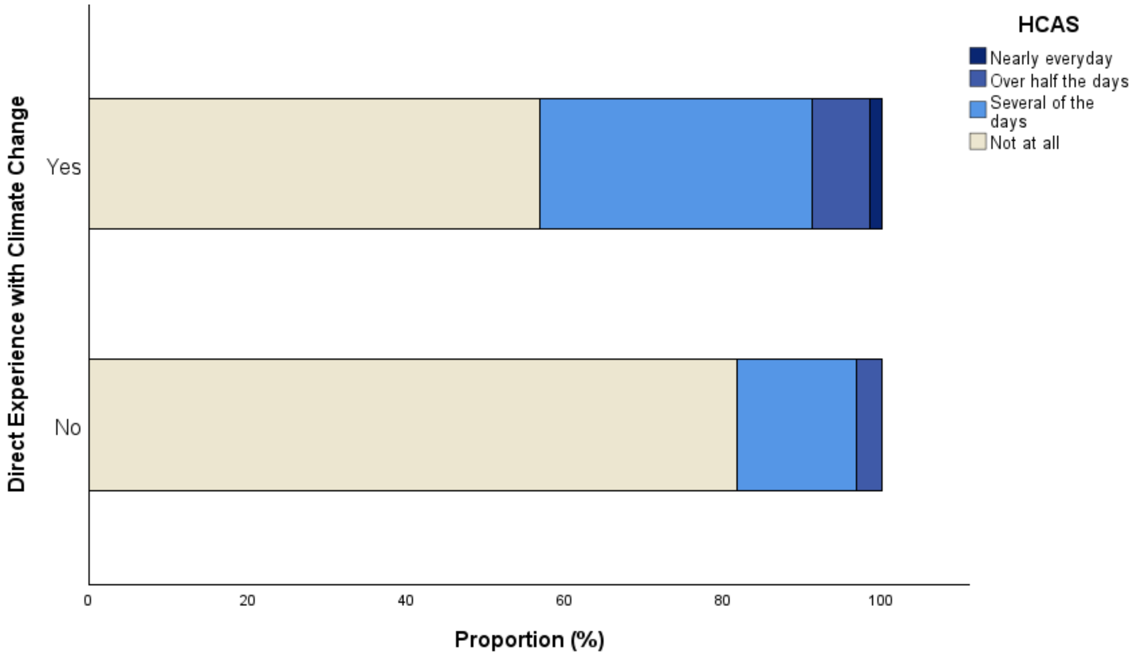
F1k – Mental Health Diagnosis



F1l – Self-rated Adaptation



F1m – Direct Experience with Climate Change



Supplementary Table F7

Prevalence of Climate Anxiety, measured by the HCAS, by Sociodemographic Variables

		Prevalence	
		Estimate (%)	95% CI
Gender			
	Female	7.4	[4.4; 11.5]
	Male	3.8	[1.7; 7.4]
Age Group			
	18 – 24	8.7	[3.7; 17.0]
	25 – 34	7.0	[2.7; 14.7]
	35 – 44	9.9	[4.8; 17.8]
	45 – 54	0	[0; 3.4]
	55 – 64	4.8	[1.4; 12.4]
	+ 65	0	[0; 4.0]
Ethnicity [a]			
	Asian	2.3	[.3; 10.4]
	Māori	15.1	[7.4; 26.5]

	Prevalence	
	Estimate (%)	95% CI
New Zealand European, Other European	3.9	[2.1; 6.6]
Pasifika	3.3	[.4; 14.5]
Yearly income (NZD)		
Loss – 60,000	3.5	[1.3; 7.4]
60,001 – 150,000	7.1	[4.2; 11.4]
150,001 or More	2.6	[.6; 8.2]
Type of Environment		
Rural/Village Residence	15.6	[7.2; 28.1]
Small or Midsized Town	2.0	[.4; 6.3]
Urban/City Residence	4.4	[2.5; 7.4]
Political orientation		
Conservative	8.0	[2.8; 17.9]
Centre	4.4	[2.4; 7.3]
Liberal	6.3	[2.7; 12.6]
Environment-based Occupation		
No	3.2	[1.8; 5.4]
Yes	23.8	[12.9; 38.1]
Mental health Diagnosis		
No	4.6	[2.8; 7.1]
Yes	8.7	[3.0; 19.4]
Preparedness for Climate Change		
Disagree	6.6	[2.8; 13.1]
Neither Agree nor Disagree	5.4	[2.6; 9.9]
Agree	4.5	[2.1; 8.3]
Direct Experience with Climate Change		
No	3.2	[1.6; 5.8]
Yes	8.7	[4.8; 14.3]

Note. HCAS = Hogg Climate Anxiety Scale. Groups with low participant numbers were not included in analyses.

Supplementary Table F8 shows the correlations between scales. People's HCAS scores were positively associated with both K10 (r = .603, p < .001) and PEBQ scores (r = .250, p < .001), and negatively associated with WHO-5 (r = -.260, p < .001), indicating that those who felt more climate anxious tended to report greater psychological distress, lower wellbeing, and more engagement in more pro-environmental actions.

Supplementary Table F8

Bivariate Correlations Between Scale Scores

	1	2	3	4	5	6	7	8
1. AS	—	.662***	.719***	.661***	.892***	.551***	-.299***	.112**
2. Rum	.631***	—	.563***	.731***	.780***	.374***	-.138**	.205***
3. BS	.738***	.577***	—	.537***	.849***	.480***	-.253***	.151**
4. PIA	.668***	.790***	.573***	—	.775***	.433***	-.162***	.265***
5. HCAS Total	.910***	.840***	.846***	.852***	—	.533***	-.277***	.196***
6. K10	.608***	.379***	.554***	.466***	.603***	—	-.514***	.064
7. WHO-5	-.291***	-.130**	-.260***	-.168***	-.260***	-.489***	—	-.011
8. PEBQ	.152**	.281***	.182***	.303***	.250***	.092	-.013	—

Note. Spearman correlations are presented above the diagonal, and Pearson correlations below the diagonal. AS = Affective Symptoms; Rum = Rumination; BS = Behavioural Symptoms; PIA = Personal Impact Anxiety; HCAS = Hogg Climate Anxiety Scale; K10 = Kessler Distress Scale; WHO-5 = Wellbeing Index; PEBQ = Pro-Environmental Behaviour Questionnaire.

* p < .05. ** p < .01. *** p < .001.

Supplementary Analysis F1

Prevalence of Climate Anxiety

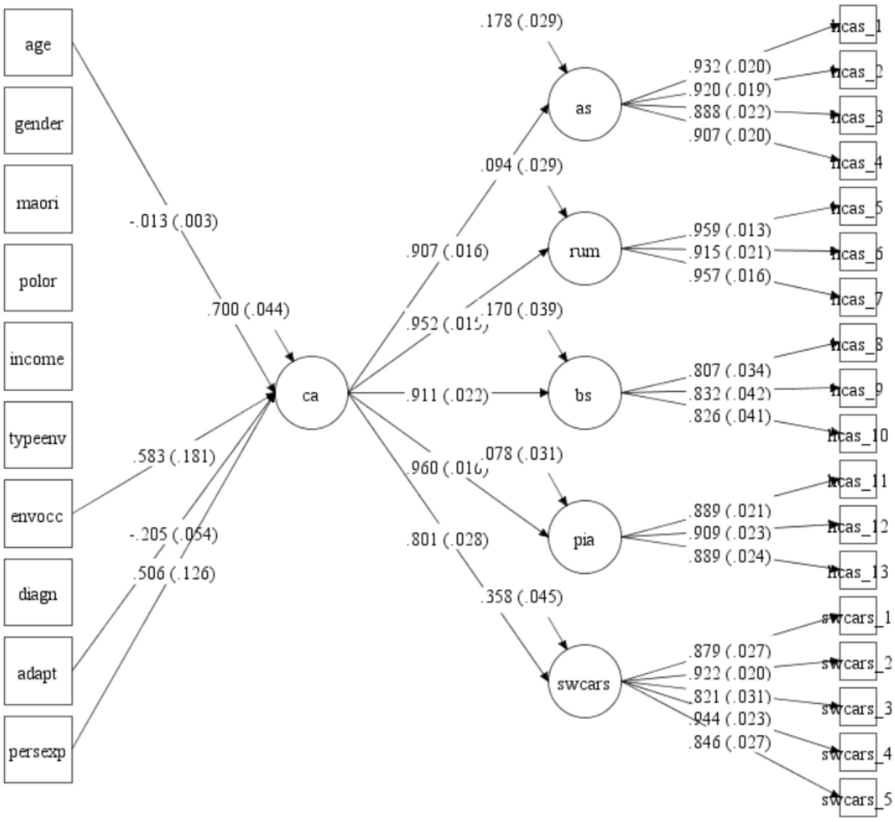
Adding the five SWCARS items resulted in a slight decrease in the prevalence of climate anxiety to 4.2% (95% CI [2.7; 6.6]), and of intense climate anxiety to .2% (95% CI [0; 1.5]).

Models for Higher-Order HCAS + WCARS Factor

The latent model predicting the higher-order HCAS + WCARS climate anxiety factor from the sociodemographic variables (Supplementary Figure F2) obtained excellent fit: χ^2 (300) = 443.720, $p < .001$; CFI = .985; TLI = .983; SRMR = .075; RMSEA = .034, $p = 1.000$; 90% CI [.027, .040]. People with environment-related jobs, $\beta = .583$, $p = .001$, 95% CI [.285; .939], who had experienced climate change impacts, $\beta = .506$, $p < .001$, 95% CI [.259; .753], who felt less prepared to handle climate change, $\beta = .205$, $p < .001$, 95% CI [.098; .312], and who were younger, $\beta = .013$, $p < .001$, 95% CI [.007; .020] experienced more climate anxiety.

Supplementary Figure F2

Latent Path Model with Sociodemographic Variables Predicting Higher-Order HCAS + WCARS Climate Anxiety Factor



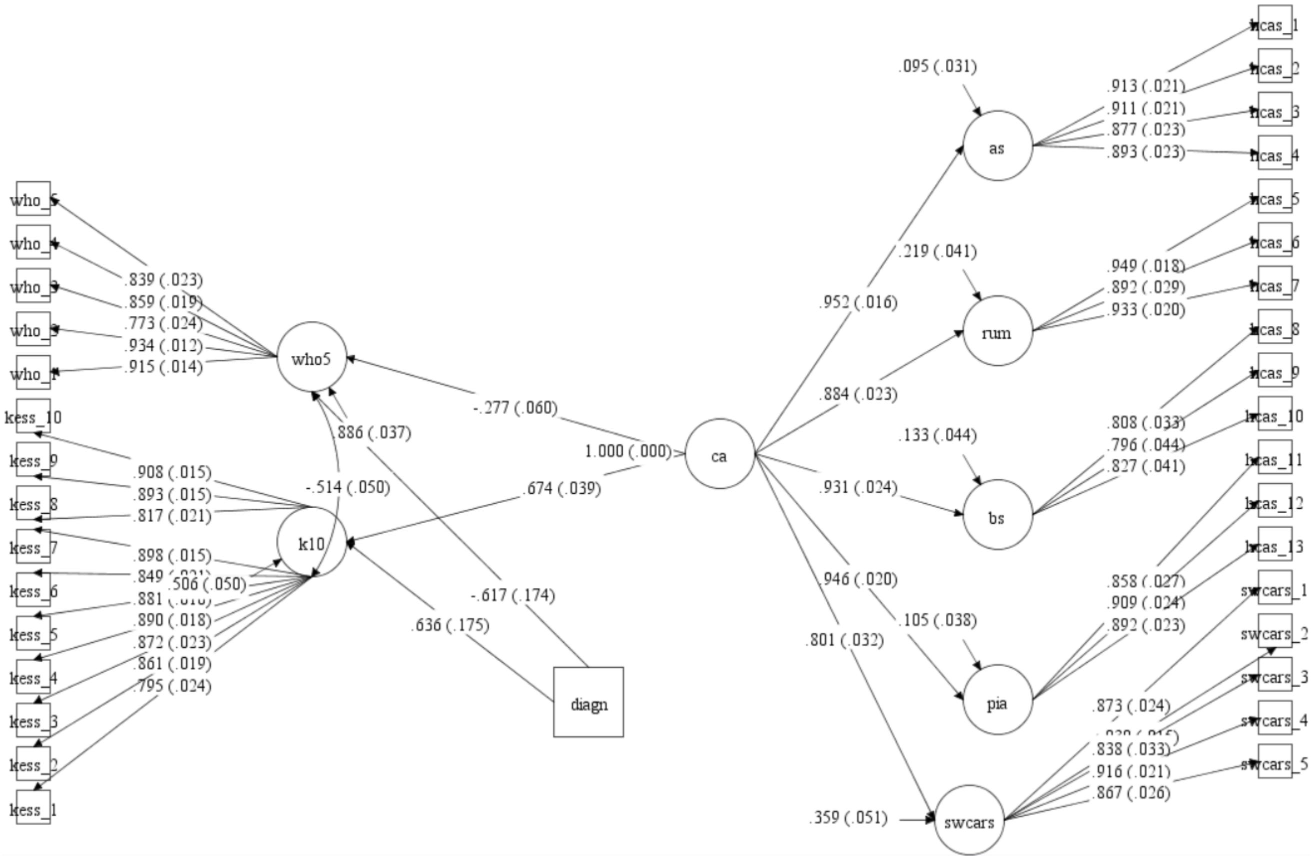
Note. Paths are standardized estimates (STDY standardization in Mplus). Only significant paths are displayed.

* $p < .05$. ** $p < .01$. *** $p < .001$.

The latent model predicting K10 and WHO-5 scores from higher-order HCAS + WCARS climate anxiety (Supplementary Figure F3) obtained excellent fit: χ^2 (518) = 893.031, $p < .001$; CFI = .980; TLI = .978; SRMR = .059; RMSEA = .041, p = 1.000; 90% CI [.037, .046]. People with more climate anxiety experienced more psychological distress, β = .674, $p < .001$, 95% CI [.599; .750], and worse wellbeing, β = -.277, $p < .001$, 95% CI [-.394; -.159], even when controlling for diagnostic status. The model explained 49.4% of variance for psychological distress, and 11.4% for wellbeing.

Supplementary Figure F3

Latent Path Model with Higher-Order HCAS + WCARS Climate Anxiety Factor Predicting Distress and Wellbeing



Note. Paths are standardized estimates (STDYX standardization in Mplus). Only significant paths are displayed.

* $p < .05$. ** $p < .01$. *** $p < .001$.

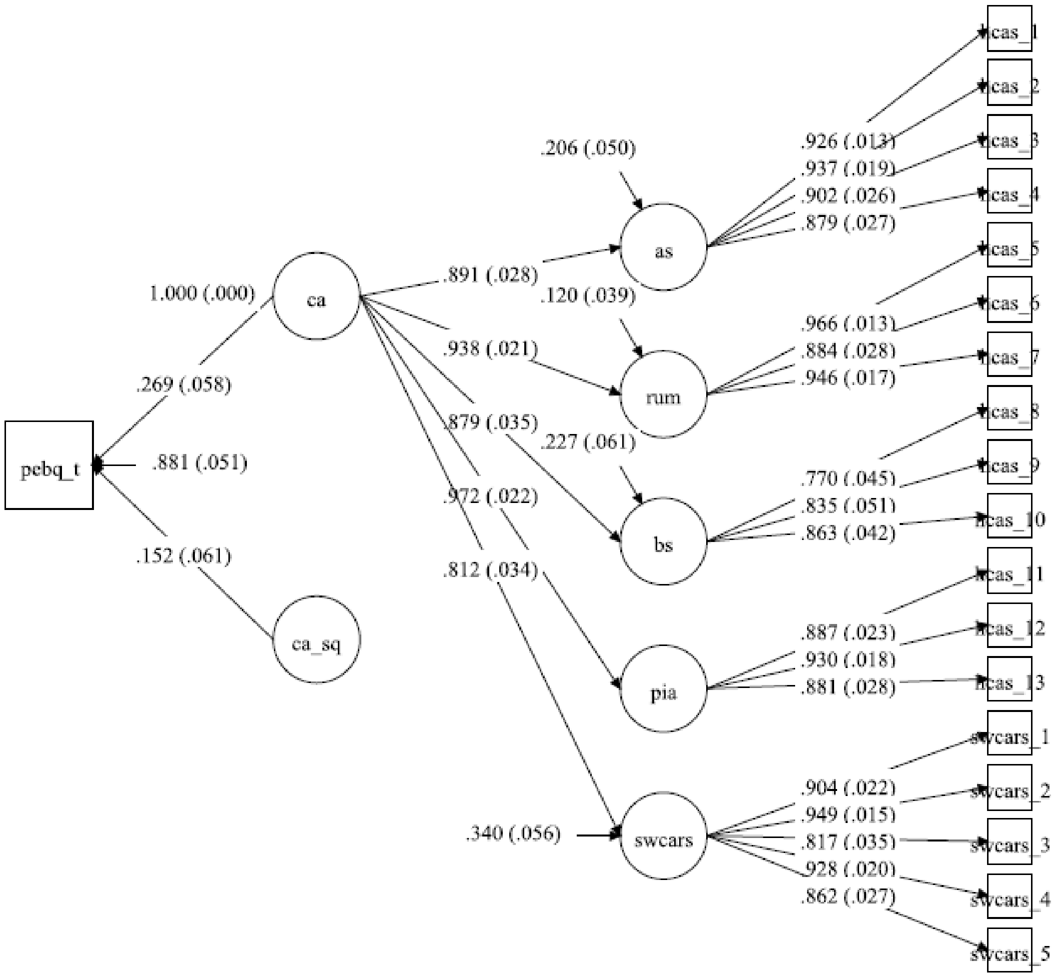
Models for Non-Linear Association Between HCAS + WCARS and PEBQ

In addition to the latent moderated structures (LMS) model reported in the main text, we used another six observed and latent approaches to examine the non-linear association between climate anxiety and pro-environmental behaviour. This included the visual inspection of the scatterplot of the bivariate correlation between climate anxiety and pro-environmental behaviour (with quadratic and linear interpolation lines), and a two-line regression (Simonsohn, 2018). Additionally, we tested three product indicator (PI) models with quadratic terms. The first two PI models were unconstrained (UPI), one using observed variables, similarly to the approach used by Hogg et al. (2024), and the second using latent variables. The third PI model used a double mean centring approach (DCA; see Slupphaug et al., 2025). Finally, we also tested a model-implied instrumental variable 2-stage least square estimator (MIIV-2SLS; see Brandt et al., 2020 for a comparison of UPI, LMS, and MIIV-2SLS approaches). We report the results for each of these approaches below, for the models using the higher-order HCAS + WCARS climate anxiety factor.

In the latent LMS model predicting PEBQ scores from linear and squared higher-order climate anxiety scores (Supplementary Figure F4), the quadratic climate anxiety term predicted PEBQ scores, $\beta = .152$, $p = .012$, 95% CI [.033; .271] even after controlling for the linear term, $\beta = .269$, $p < .001$, 95% CI [.155; .383]. Overall, climate anxiety explained 11.9% of the variance of PEBQ scores.

Supplementary Figure F4

Latent Path Model with Linear and Squared Higher-Order HCAS + WCARS Climate Anxiety FACTOR Predicting Pro-Environmental Behaviour

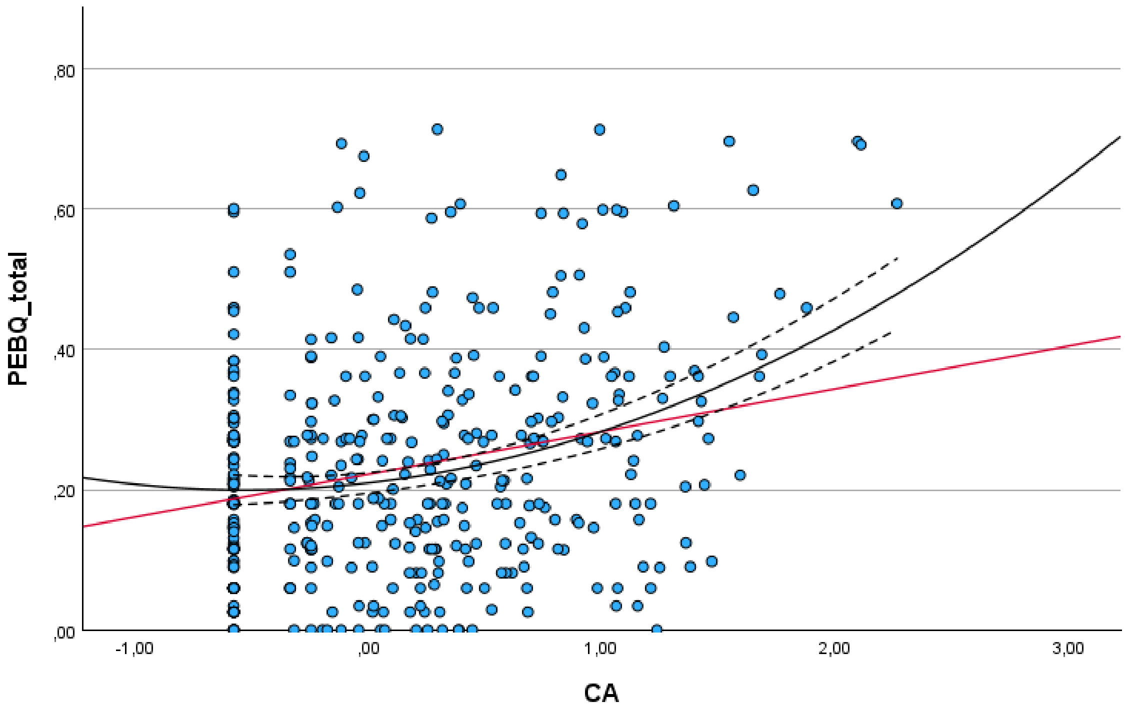


Note. Paths are standardized estimates. Only significant paths are displayed.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Supplementary Figure F5 depicts the scatterplot for the bivariate correlation between the HCAS + WCARS latent climate anxiety factor and PEBQ scores, showing that not only are climate anxious people more likely to engage in pro-environmental behaviours, but the association between climate anxiety and pro-environmental behaviour is stronger at high levels of climate anxiety.

Supplementary Figure F5

Scatterplot for Higher-Order HCAS + WCARS Latent Climate Anxiety and PEBQ Scores

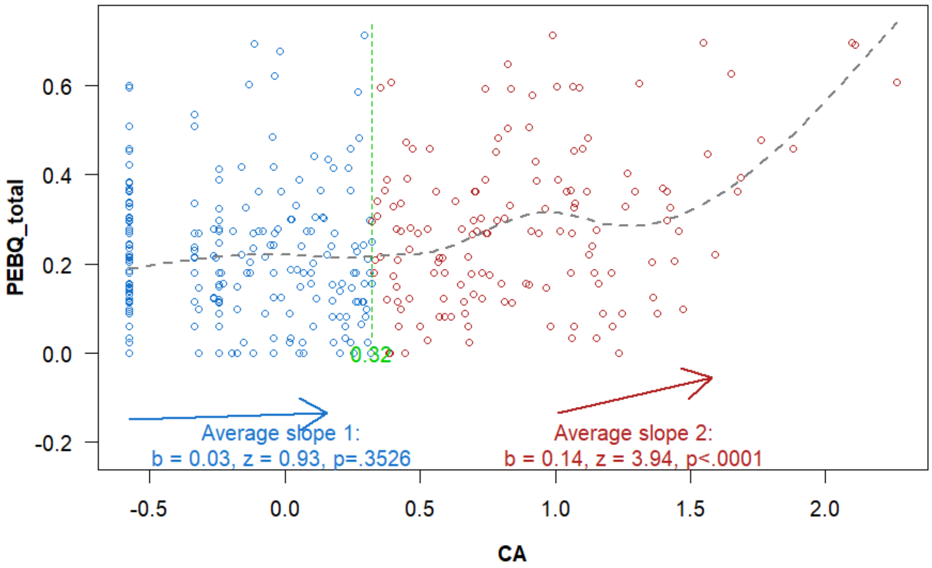


Note. Red lines represent linear effect, and the black lines represent the quadratic effects. Dashed lines represent 95% CI of quadratic effects.

The two-line approach (Simonsohn, 2017) suggested that for the higher-order climate anxiety factor, the first regression slope, at low levels of climate anxiety, did not significantly predict pro-environmental behaviour (b = .03, p = .353), while the second regression slope, at high levels of climate anxiety, significantly predicts pro-environmental behaviour (b = .14, p < .001). These results suggest a non-linear association consistent with the scatterplot results, whereby the association between climate anxiety and pro-environmental behaviour becomes stronger as climate anxiety increases. Supplementary Figure F6 shows the two lines and the breakpoint identified by the algorithm, though Simonsohn (2017) advises against the interpretability of this value.

Supplementary Figure F6

Two-line regression for predicting pro-environmental behaviour from higher-order climate anxiety factor



The UPI observed regression approach (as used by Hogg et al., 2024) for the higher-order climate anxiety factor showed that the quadratic term significantly predicted PEBQ scores, *b* = .036, *p* = .032, 95% CI [.003; .069] and significantly improved the model's predictive power over just the linear term, R^2 = .075, ΔR^2 = .11, *p* = .032. The UPI latent model for the higher-order climate anxiety factor did not run using WLSMV estimation. Using MLR estimation, the quadratic term was not significant *b* = .013, SE = .033, *p* = .697. This model did not obtain acceptable fit: scaled χ^2 (165) = 582.654, *p* < .001; robust CFI = .814; robust TLI = .786; robust SRMR = .200; robust RMSEA = .121, *p* < .001; 90% CI [.111, .132] (fit indices can be unreliable for UPI approaches, see Brandt et al., 2020). Using the DCA approach with higher-order factors was too computationally intensive, so we were unable to test it for the HCAS + WCARS model.

The MIIV-2SLS approach (with unweighted data and using listwise deletion) did not yield a model with acceptable fit for the higher-order climate anxiety factor, as the Sargan test was significant for several indicators, indicating structural misspecification and violating assumptions of the approach (see Brandt et al., 2020).

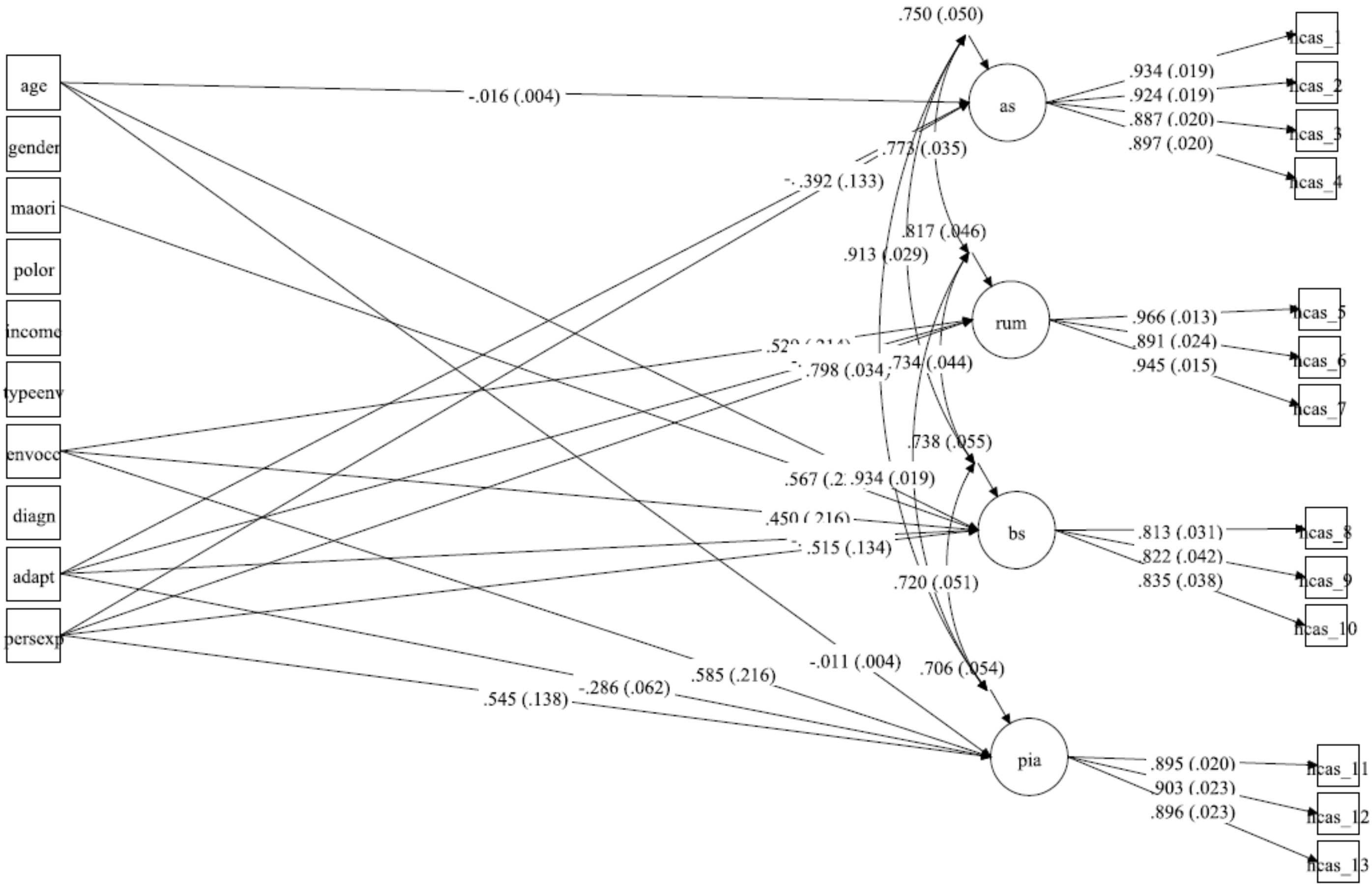
Supplementary Analyses F2

Models for HCAS Dimensions

The latent model predicting HCAS dimensions from the sociodemographic variables (Supplementary Figure F7) obtained excellent fit: χ^2 (149) = 164.049, *p* = .189; CFI = .998; TLI = .997; SRMR = .046; RMSEA = .016, *p* = 1.000; 90% CI [.000, .028]. Affective symptoms were experienced more by people who had experienced climate change impacts, *β* = .392, *p* = .003, 95% CI [.132; .652], with environment-related jobs, *β* = .374, *p* = .049, 95% CI [.001; .747], who felt less prepared to handle climate change, *β* = .148, *p* = .021, 95% CI [.022; .275], and who were younger, *β* = .016, *p* < .001, 95% CI [.009; .023]. Rumination was experienced more by people who had experienced climate change impacts, *β* = .643, *p* < .001, 95% CI [.366; .920], with environment-related jobs, *β* = .529, *p* = .014, 95% CI [.108; .949], who felt less prepared to handle climate change, *β* = .158, *p* = .014, 95% CI [.032; .283]. Behavioural symptoms were experienced more by Māori, *β* = .567, *p* = .015, 95% CI [.109; 1.026], people who had experienced climate change impacts, *β* = .515, *p* < .001, 95% CI [.251; .778], with environment-related jobs, *β* = .450, *p* = .037, 95% CI [.027; .873], who felt less prepared to handle climate change, *β* = .128, *p* = .044, 95% CI [.004; .253], and who were younger, *β* = .011, *p* = .005, 95% CI [.005; .019]. Personal Impact Anxiety was experienced more by people with environment-related jobs, *β* = .585, *p* = .007, 95% CI [.163; 1.008], who had experienced climate change impacts, *β* = .545, *p* < .001, 95% CI [.275; .816], who felt less prepared to handle climate change, *β* = .286, *p* < .001, 95% CI [.164; .409], and who were younger, *β* = .011, *p* = .003, 95% CI [.004; .019].

Supplementary Figure F7

Latent Path Model with Sociodemographic Variables Predicting HCAS Dimensions

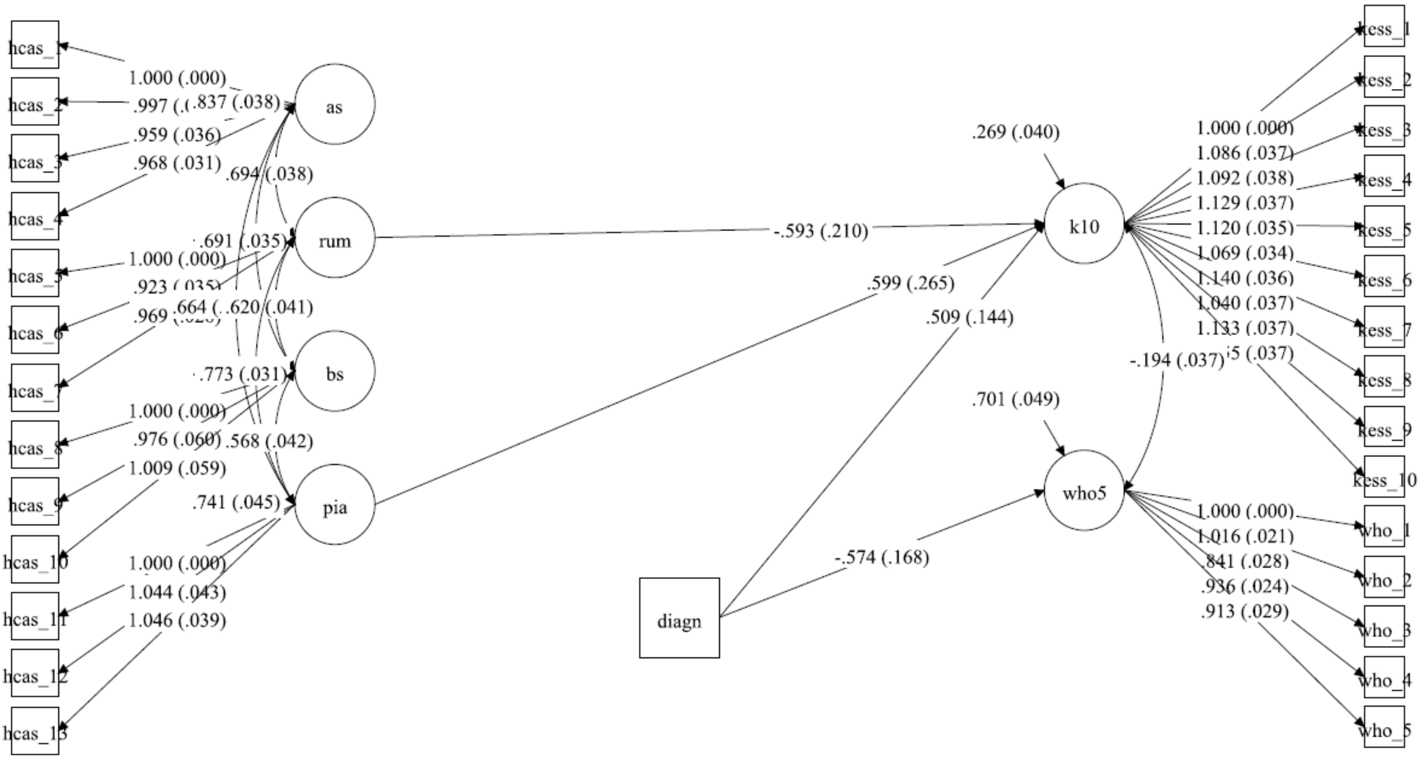


Note. Paths are standardized estimates. Only significant paths are displayed.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

The latent model predicting K10 and WHO-5 scores (Supplementary Figure F8) obtained excellent fit: χ^2 (361) = 592.035, p < .001; CFI = .986; TLI = .985; SRMR = .047; RMSEA = .039, p = 1.000; 90% CI [.033, .044]. People who ruminated less, β = -.707, p = .005, 95% CI [-1.201; -.214], and had higher personal impact anxiety, β = .643, p = .023, 95% CI [.089; 1.196] had higher psychological distress when controlling for diagnostic status. No HCAS dimensions predicted wellbeing after controlling for diagnosis. The model explained 58.2% of variance for psychological distress, and 19.2% for wellbeing.

Supplementary Figure F8

Latent Path Model with HCAS Dimensions Predicting Distress and Wellbeing



Note. Paths are standardized estimates. Only significant paths are displayed.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

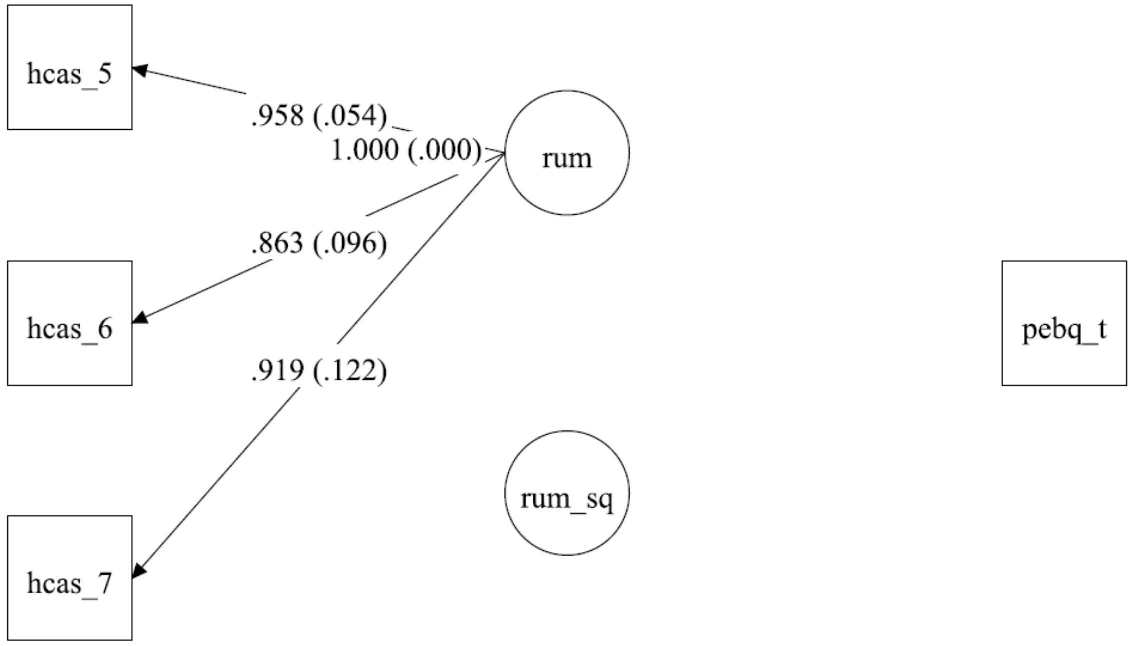
Models for Non-Linear Association Between HCAS Dimensions and PEBQ

In addition to the latent moderated structures (LMS) model reported in the main text, we used another six observed and latent approaches to examine the non-linear association between climate anxiety dimensions and pro-environmental behaviour. This included the visual inspection of the scatterplot of the bivariate correlation between each climate anxiety dimension and pro-environmental behaviour (with quadratic and linear interpolation lines), and two-line regressions (Simonsohn, 2018). Additionally, we tested three product indicator (PI) models with quadratic terms. The first two PI models were unconstrained (UPI), one using observed variables, similarly to the approach used by Hogg et al. (2024), and the second using latent variables. The third PI model used a double mean centring approach (DCA; see Slupphaug et al., 2025). Finally, we also tested a model-implied instrumental variable 2-stage least square estimator (MIIV-2SLS; see Brandt et al., 2020 for a comparison of UPI, LMS, and MIIV-2SLS approaches). We report the results for each of these approaches below, for the models using the HCAS dimension scores.

In the latent LMS model predicting PEBQ scores from linear and squared HCAS dimension scores, the quadratic climate anxiety term did not predict PEBQ scores for rumination, β = .069, p = .299, 95% CI [-.241; .919] and behavioural symptoms, β = ., p = .012, 95% CI [-.061; .199], but was significant for personal impact anxiety, β = .350, p = .016, 95% CI [.066; .634] (see Supplementary Figures F9a-F9c). Our models indicate rumination had no association, behavioural symptoms had a linear association, and personal impact anxiety had a non-linear association with pro-environmental behaviour. The estimation of the model for the affective symptoms dimension did not terminate normally and is therefore not reported. Overall, the models explained between 4.9% (behavioural symptoms) and 28.5% (personal impact anxiety) of the variance of PEBQ scores.

Supplementary Figure F9a

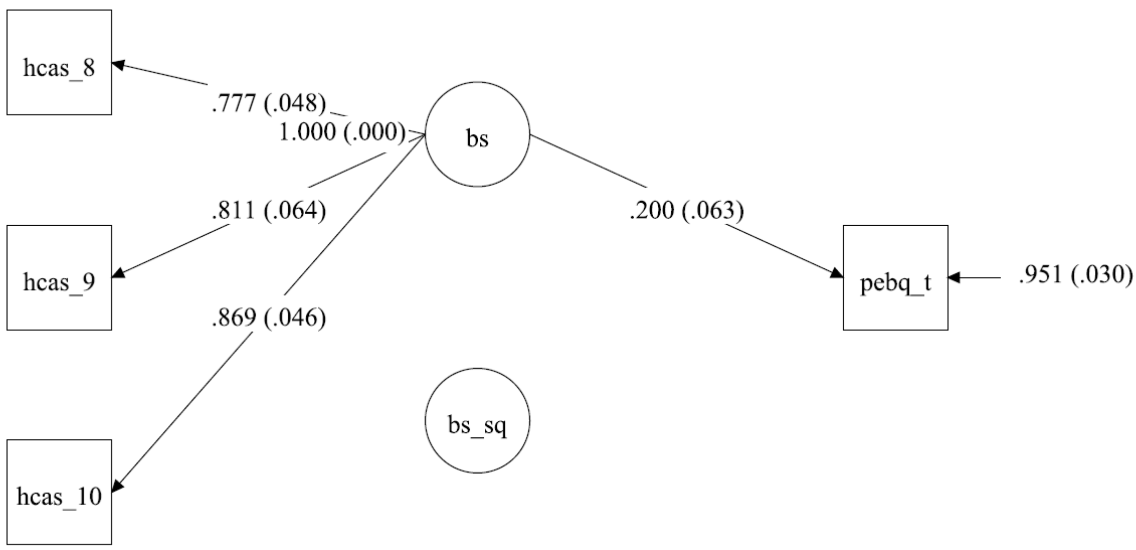
Latent Path Model with Linear and Squared Rumination Predicting Pro-Environmental Behaviour



Note. Paths are standardized estimates. Only significant paths are displayed.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Supplementary Figure F9b

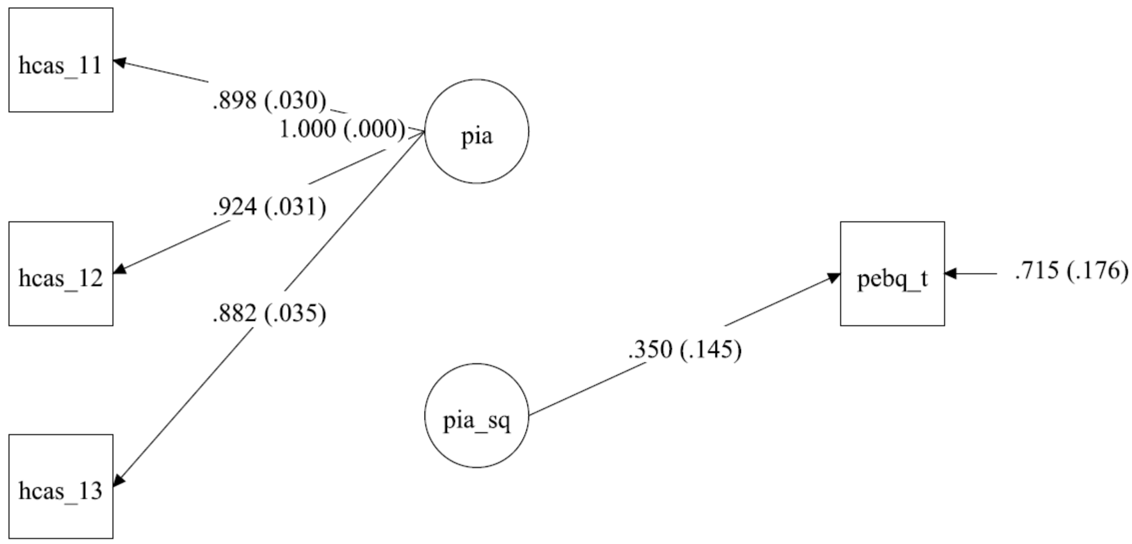
Latent Path Model with Linear and Squared Behavioural Symptoms Predicting Pro-Environmental Behaviour



Note. Paths are standardized estimates. Only significant paths are displayed.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Supplementary Figure F9c

Latent Path Model with Linear and Squared Personal Impact Anxiety Predicting Pro-Environmental Behaviour

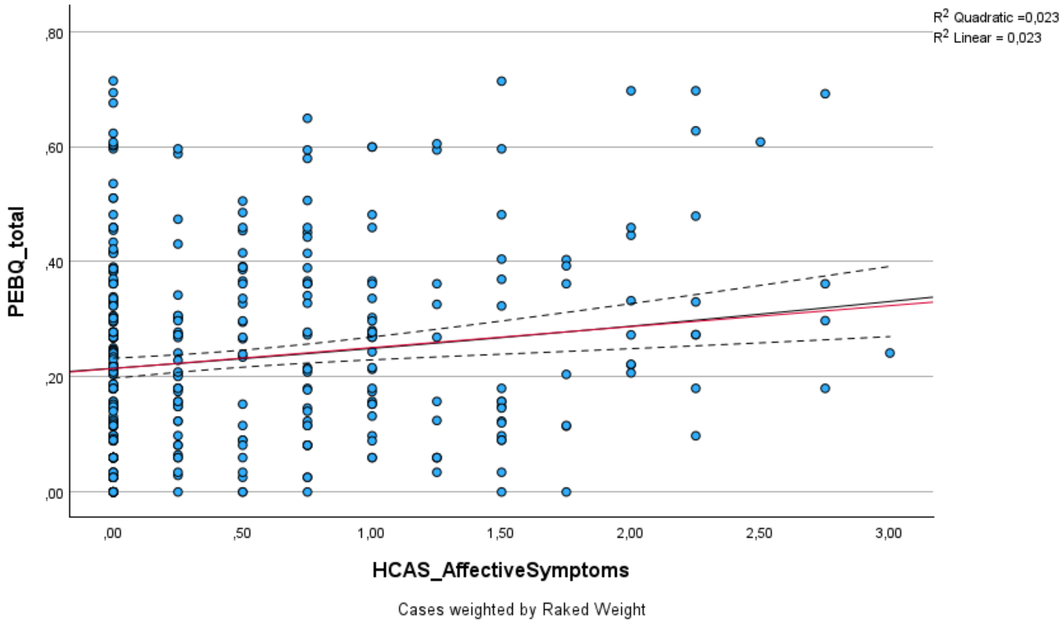


Note. Paths are standardized estimates. Only significant paths are displayed.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Supplementary Figures F10a-F10d depict the scatterplot for each HCAS dimension and PEBQ scores, showing that people who had more climate anxiety were also more likely to engage in pro-environmental behaviour. The scatterplot results thus differ from the LMS results, suggesting that each HCAS dimension is linearly associated with pro-environmental behaviour.

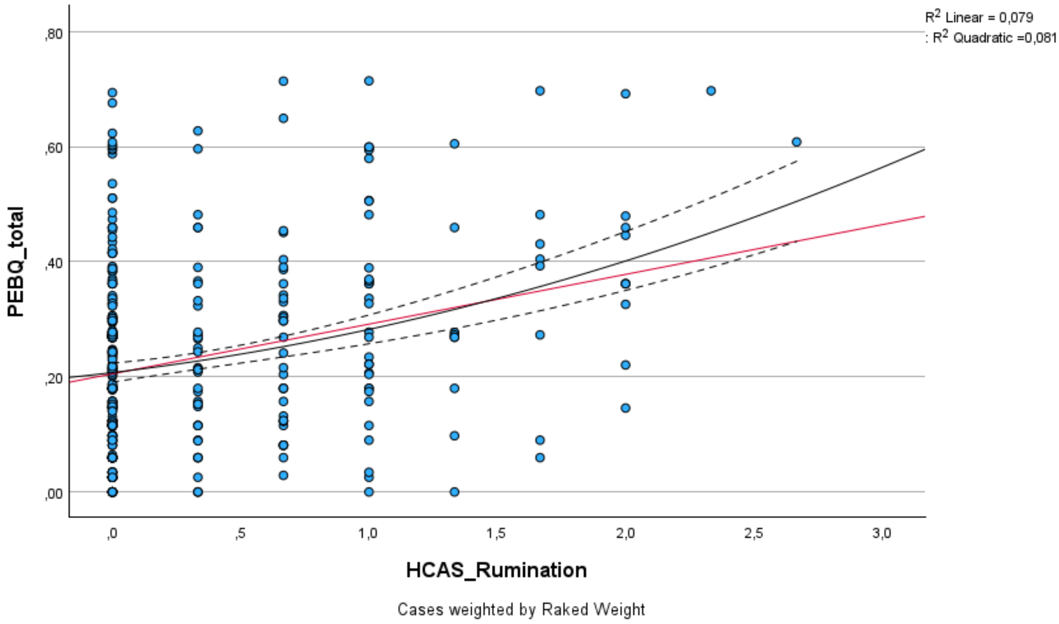
Supplementary Figure F10a

Scatterplot for Affective Symptoms and PEBQ Scores



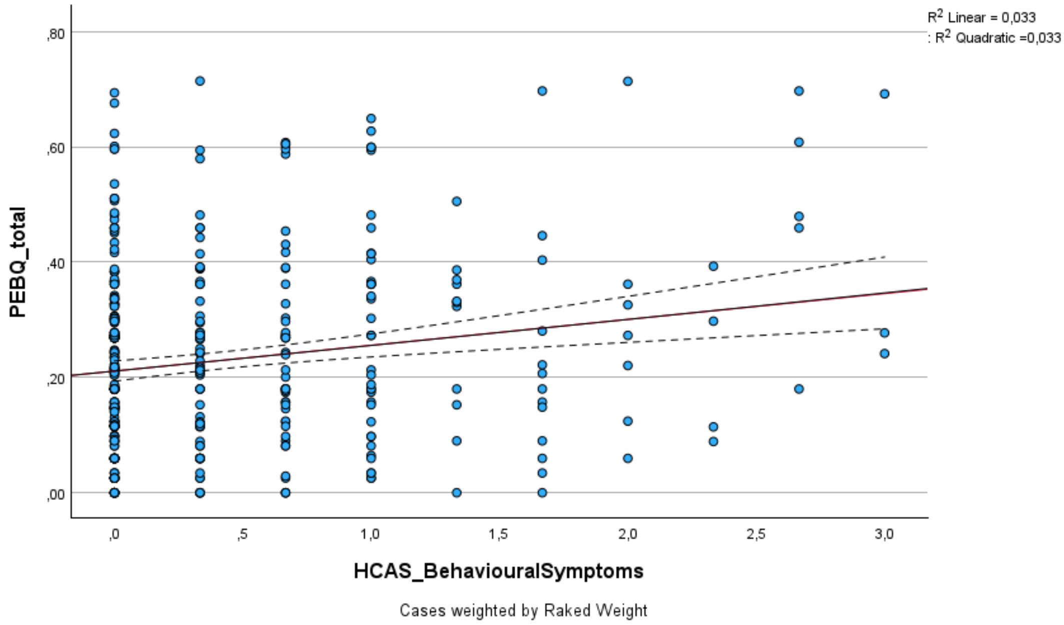
Supplementary Figure F10b

Scatterplot for Rumination and PEBQ Scores



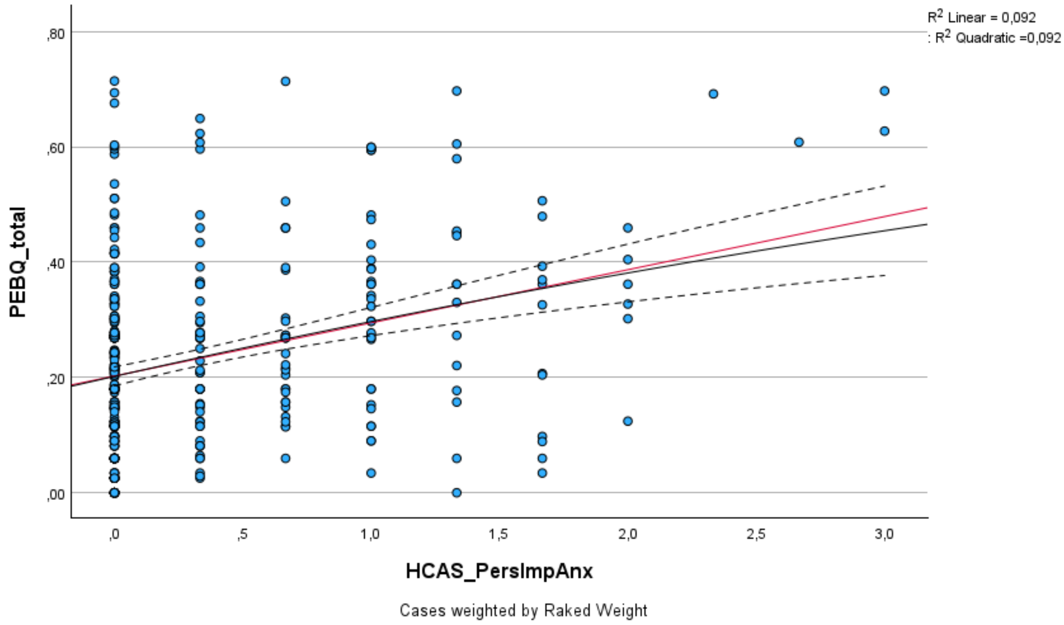
Supplementary Figure F10c

Scatterplot for Behavioural Symptoms and PEBQ Scores



Supplementary Figure F10d

Scatterplot for Personal Impact Anxiety and PEBQ Scores



Note. Red lines represent linear effect, and the black lines represent the quadratic effects.

Dashed lines represent 95% CI of quadratic effects.

The two-line approach (Simonsohn, 2017) suggested that each HCAS dimension had a stronger association with pro-environmental behaviour at high climate anxiety levels (Supplementary Table F9), indicating non-linear associations where the association between climate anxiety and pro-environmental behaviour becomes stronger as climate anxiety increases (see Supplementary Figures F11a-F11d).

Supplementary Table F9

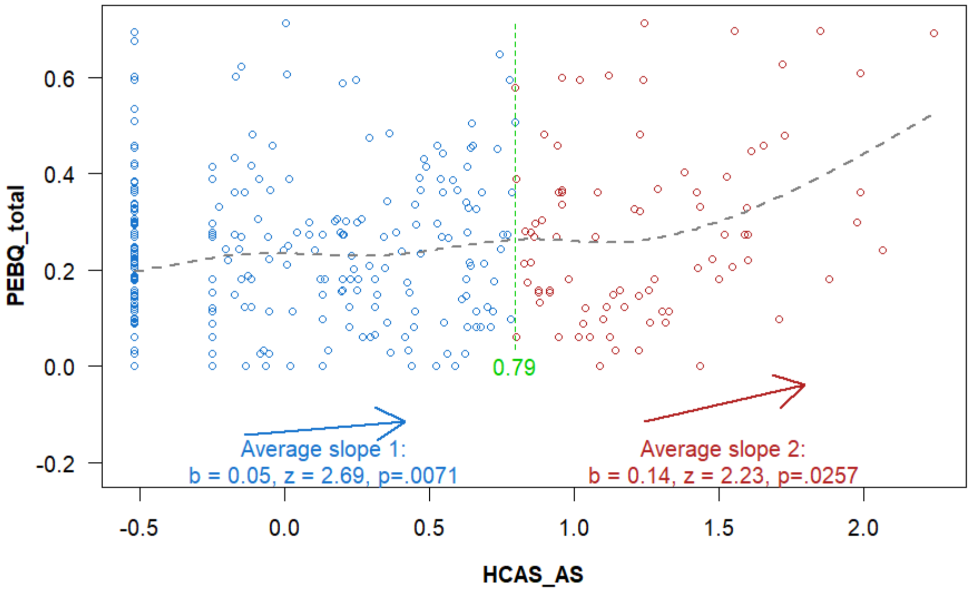
Two-line Regression Models Predicting Pro-Environmental Behaviour from HCAS Dimensions

HCAS Dimensions	B
Affective Symptoms	
Slope 1	.005**
Slope 2	.014*
Rumination	
Slope 1	.003
Slope 2	.014***
Behavioural Symptoms	
Slope 1	.006
Slope 2	.013***
Personal Impact Anxiety	
Slope 1	.003
Slope 2	.015***

* $p < .05$. ** $p < .01$. ***$p < .001$.

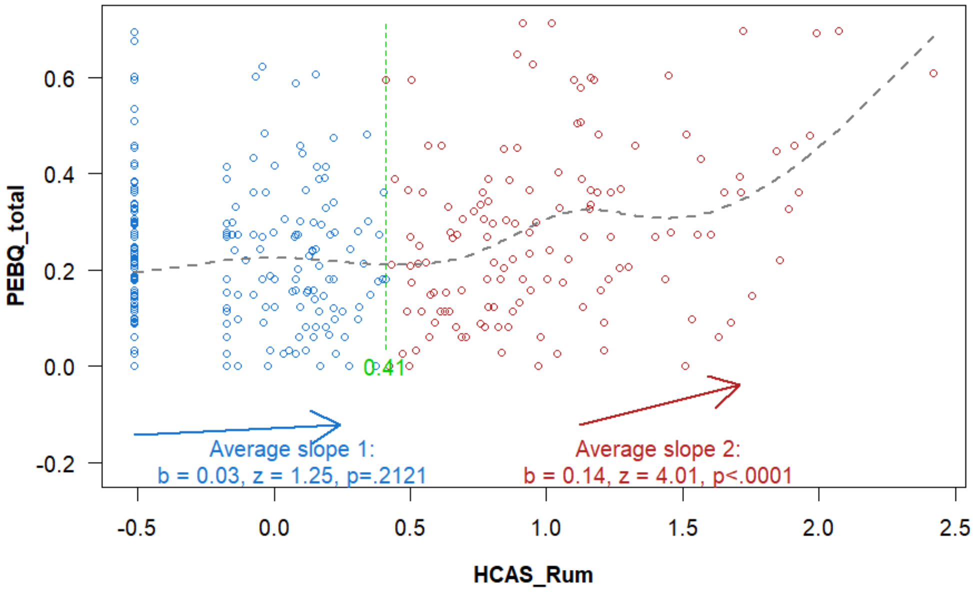
Supplementary Figure F11a

Two-line Regression for Predicting Pro-Environmental Behaviour from Affective Symptoms



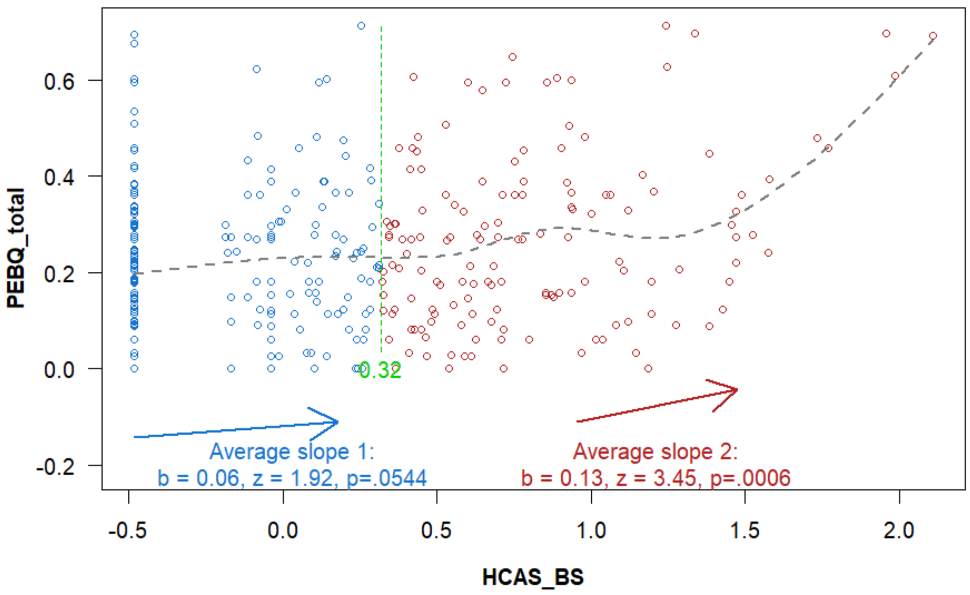
Supplementary Figure F11b

Two-line Regression for Predicting Pro-Environmental Behaviour from Rumination



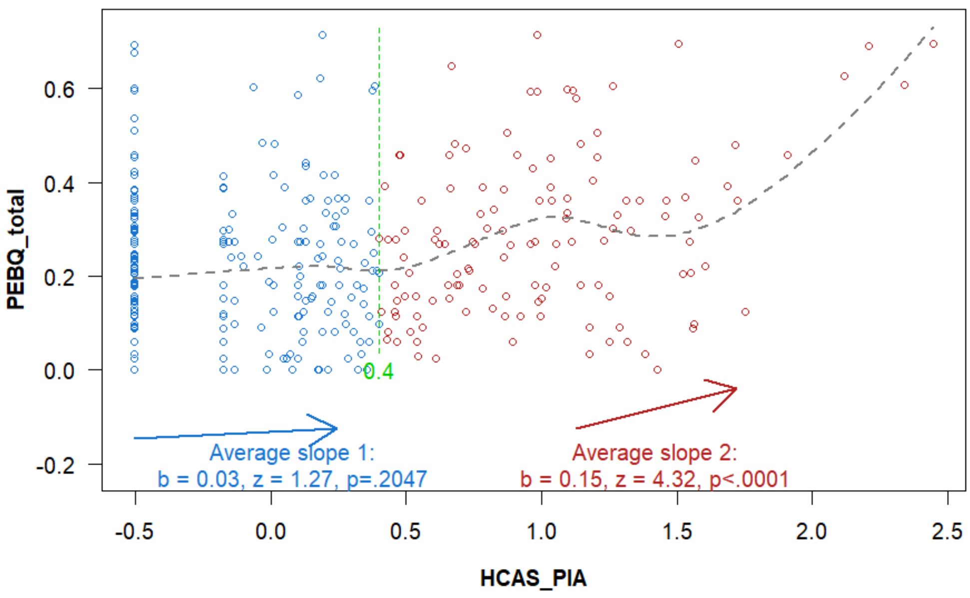
Supplementary Figure F11c

Two-line Regression for Predicting Pro-Environmental Behaviour from Behavioural Symptoms



Supplementary Figure F11d

Two-line Regression for Predicting Pro-Environmental Behaviour from Personal Impact Anxiety



The UPI observed regression model showed each HCAS dimension positively predicted pro-environmental behaviour, but none had a significant non-linear effect (Supplementary Table F10). When using a latent UPI model or a DBA approach, all HCAS dimensions obtained very poor model fit, making the models unsuitable for interpretation.

Supplementary Table F10

UPI Observed Regression Models Predicting Pro-Environmental Behaviour from HCAS Dimensions

HCAS Dimensions		B	95% CI	R^2	ΔR^2
Affective Symptoms					
Step 1	Linear	.036**	[.014;.059]	.023	
Step 2	Linear	.032	[-.030;.094]		
	Quadratic	.002	[-.028;.032]	.023	.000
Rumination					
Step 1	Linear	.086***	[.058;.115]	.077	
Step 2	Linear	.053	[-.023;.129]		
	Quadratic	.022	[-.024;.068]	.081	.002
Behavioural Symptoms					
Step 1	Linear	.045***	[.021;.068]	.033	
Step 2	Linear	.044	[-.014;.102]		
	Quadratic	.000	[-.025;.026]	.033	.000
Personal Impact Anxiety					
Step 1	Linear	.092***	[.064;.120]	.092	
Step 2	Linear	.101**	[.027;.174]		

	Quadratic	-.005	[-.050;.039]	.092	.000

* $p < .05$. ** $p < .01$. *** $p < .001$.

The MIIV- 2SLS approach also did not yield a model with acceptable fit for three out of the four HCAS dimensions. Only for the behavioural symptoms dimension did the MIIV-2LS approach suggest a properly specified model where the quadratic term was statistically significant, b = .220, SE = .107, p =.039, suggesting the existence of a non-linear association between behavioural symptoms and pro-environmental behaviour.

Supplementary Analyses F3

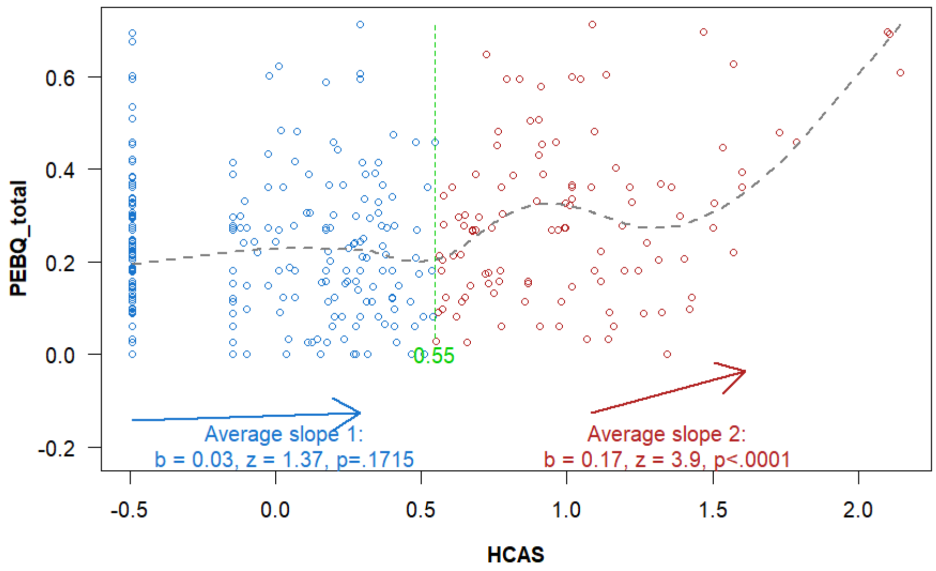
Additional Approaches for Models Predicting Pro-Environmental Behaviour from HCAS

In addition to the latent moderated structures (LMS) model reported in the main text, we used another six observed and latent approaches to examine the non-linear association between climate anxiety and pro-environmental behaviour. This included the visual inspection of the scatterplot of the bivariate correlation between each climate anxiety dimension and pro-environmental behaviour (with quadratic and linear interpolation lines), and two-line regressions (Simonsohn, 2018). Additionally, we tested three product indicator (PI) models with quadratic terms. The first two PI models were unconstrained (UPI), one using observed variables, similarly to the approach used by Hogg et al. (2024), and the second using latent variables. The third PI model used a double mean centring approach (DCA; see Slupphaug et al., 2025). Finally, we also tested a model-implied instrumental variable 2-stage least square estimator (MIIV-2SLS; see Brandt et al., 2020 for a comparison of UPI, LMS, and MIIV-2SLS approaches). We report the results for each of these approaches below, for the models using the HCAS higher-order factor score.

Using a two-line approach, we obtained a significant non-linear effect, with low levels of climate anxiety not predicting PEBQ scores, first slope b = .03, p = .172, and higher levels of climate anxiety positively predicting PEBQ scores, second slope *b* = .17, *p* < .001 (Supplementary Figure F12). This suggests that the association between climate anxiety and pro-environmental behaviour becomes stronger as climate anxiety increases.

Supplementary Figure F12

Two-line regression for predicting pro-environmental behaviour from HCAS



Using the UPI observed regression model approach, the quadratic term did not significantly predict PEBQ scores, *b* = .029, *p* = .196, 95% CI [-.015; .073] and did not improve the model's predictive power, R^2 = .066, ΔR^2 = .004, *p* = .196, suggesting a linear association. Using a latent UPI model (with WLSMV estimation), the model fit was unsatisfactory: scaled χ^2 (86) = 360.313, *p* < .001; robust CFI = .879; robust TLI = .852; robust SRMR = .224; robust RMSEA = .097, *p* < .001; 90% CI [.087, .108]. Both a DBA and a MIIV-2SLS approach resulted in similarly poor model fit, making the models unsuitable for interpretation.

Supplementary Table F11

Summary of Supplementary Analyses for Non-Linear Association Between Climate Anxiety and Pro-Environmental Behaviour

	HCAS + SWCARS (Supplementary Analysis 1)	Dimensions (Supplementary Analysis 2)				HCAS (Supplementary Analysis 3)
		AS	*Rum*	*BS*	*PIA*	
Scatterplot	Non-linear (Stronger at high levels)	Linear positive	Linear positive	Linear positive	Linear positive	Linear (Some curve, but within CI)
Two-line	Non-linear (Significant only at high levels)	Non-linear (Significant at both levels, stronger at high-level)	Non-linear (Significant only at high levels)	Non-linear (Significant only at high levels)	Non-linear (Significant only at high levels)	Non-linear (Significant only at high levels)
UPI Observed Regression	Non-linear (Quadratic term significant and improves R^2)	Linear (Quadratic term not significant)	Linear (Quadratic term not significant)	Linear (Quadratic term not significant)	Linear (Quadratic term not significant)	Linear (Quadratic term not significant)
UPI Latent Model	Poor model fit	Poor model fit	Poor model fit	Poor model fit	Poor model fit	Poor model fit
DBA	can't run higher-order (runtime too long)	Poor model fit and assumptions	Poor model fit and assumptions	Poor model fit and assumptions	Poor model fit and assumptions	Poor model fit
QML	can't run higher-order	No etas found	No etas found	No etas found	No etas found	can't run higher-order
LMS (Mplus)	Non-linear (Quadratic term significant)	Estimation did not terminate normally	No association	Linear (Quadratic term not significant)	Non-linear (Only quadratic term significant)	**<u>Linear (Quadratic term not significant)</u>**
MIIV-2SLS	Poor model fit and assumptions	Poor model fit and assumptions	Poor model fit and assumptions	Non-linear (Only quadratic term significant)	Poor model fit and assumptions	Poor model fit and assumptions

Note. Green-shaded cells indicate significant non-linear effect, yellow-shaded cells indicate a linear effect, red-shaded cells indicate poor model fit.

Cell in bold and underlined represents model reported in the main text.