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An overview at ecoanxiety worldwide differences: a systematic review

Una mirada panorámica a las diferencias mundiales sobre ecoansiedad: una revisión sistemática

Autor: Gorka Mediavilla Briones

Directora: Jéssica Alonso Molero

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"This is a bit like a drug addict, who destroys their own body day after day in order to feel good for a little while longer."

Man, 53 years old, about climate change.

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A Jéssica, por aceptar hacer este trabajo e introducirme en el mundo de la investigación, y por haberme animado y enseñado en este proceso. Gracias.

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Abstract *(English)*

Background: The expected increase in adverse climate change effects has led in certain people to feel anxiety-related feelings, which is ecoanxiety. The primary aim of this systematic review is to explore the differences on ecoanxiety between different countries in a qualitative way and to compare the results according to their socioeconomic development. **Methods:** This review focused on articles that explored ecoanxiety and were conducted within a predetermined country or geographical area. The research was performed in PubMed, Scopus, Web of Science, and Cochrane until November 2022. The articles were filtered according to the title, abstract, and full-text review following the PRISMA methodology. **Results:** Thirteen studies met the inclusion criteria. All the articles showed ecoanxiety. Most articles were conducted in developed countries. **Discussion:** Lower developed countries tended to score higher ecoanxiety, although controversy exits. More research is needed to fill the existing underrepresentation in the literature from low and medium developed countries. Limitations from some articles included were small sample use and the absence of ecoanxiety measuring tools in some of them.

Keywords: ecoanxiety, climate change anxiety, countries, socioeconomic level, low developed countries

Resumen *(Castellano)*

Introducción: La previsión de un aumento de las consecuencias negativas del cambio climático ha llevado a ciertas personas a sentir preocupación y ansiedad por estos hechos; es decir, ecoansiedad. El objetivo principal de esta revisión sistemática es explorar de una manera cualitativa las diferencias en cuanto a ecoansiedad en los diferentes países y analizar los resultados de acuerdo con su nivel socioeconómico. **Métodos:** Se han tenido en cuenta artículos que estudiaban la ecoansiedad llevados a cabo en un país o áreas geográficas concretas. La búsqueda de bibliografía se realizó en PubMed, Scopus, Web of Science y Cochrane hasta noviembre de 2022. Los artículos fueron filtrados por título, resumen y revisión completa del texto siguiendo la metodología PRISMA. **Resultados:** Trece estudios fueron incluidos. Todos ellos mostraron ecoansiedad. La mayoría fueron llevados a cabo en países desarrollados. **Discusión:** Los países menos desarrollados parecen mostrar mayor ecoansiedad, aunque existe controversia al respecto. Es necesaria más investigación en países de bajo y medio desarrollo para cubrir la falta de representación de estos países en la literatura disponible. Algunas limitaciones incluyen muestras pequeñas en algunos estudios y ausencia de herramientas de medida de ecoansiedad en otros.

Palabras clave: ecoansiedad, ansiedad climática, países, nivel socioeconómico, países subdesarrollados

1. Introduction

In 1992, the United Nations Framework Convention on Climate Change (UNFCCC) defined *climate change* as a "change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable periods" (1). The global surface temperature of the planet has increased over 1.1 ºC due to greenhouse gas emissions in the 2011-2020 period compared to the 1850-1900 period (2). This temperature elevation already affects many regions and causes negative impacts to nature and people (2).

Climate change impacts negatively to biodiversity and ecosystems and threats humans' wellbeing and health by worsening water scarcity and food availability and security; putting at risk infrastructures, landscapes, and cities; and direct or indirectly harming human health (increasing infectious diseases, heat, malnutrition, displacement, and mental health problems) (3). Already in 2009, the Lancet Commission on Managing the Health Effects of Climate Change declared the climate change as the greatest 21st century health threat worldwide (4).

According to the International Panel on Climate Change's (IPCC) Sixth Synthesis Report (2), the likelihood of future climate change induced unavoidable and abrupt consequences will increase as the global temperature continues to rise. The expected short-term threats include heat-related human morbimortality increase; vector-borne, water-borne, and food-borne diseases increase; food production drop; flooding; biodiversity loss; and mental health related changes (2). The severity of these effects will increase if global temperature elevation continues, becoming more unpredictable and difficult to tackle (2).

With this scenario, concern about the climate change has led in certain people to feel anxiety, worry and a large broad spectrum of anxiety-related feelings about possible future scenarios, a phenomenon known as ecoanxiety or climate change anxiety (5–8). This novel concept about climate emotions has created confusion and generates debate about its precise definition (7,9,10). Nevertheless, the most popular definition of ecoanxiety is the one given by the American Psychological Association and ecoAmerica, who define climate change anxiety as 'a chronic fear of environmental doom' (5,7). Climate change anxiety is not considered a mental illness, even though it can lead to mental health impair (5–7,9).

It has been proposed that certain collectives are more vulnerable to the negative effects of climate change on mental health. In this way, ecoanxiety seems to be greater in younger adults (5,6,11,12) and might be influenced by multiple factors, such as belongingness to minority groups, elderly, childhood, gender, climate change vulnerability or economic vulnerability (5,9,12–14).

Countries with lower income are especially vulnerable to climate change impacts and to suffering climate-related disasters (2,15), even though their contribution to climate

change development is smaller (14,16). In addition, the countries affected by climate change present different capability to face its effects attending their economic and social framework strength (5,15,17–19). Despite research around indirect effects of climate change has grown in the last years, only a few articles have studied the existing differences on climate change anxiety between geographical areas and countries (18–20). Most of the literature, moreover, focuses on high-income countries (15,18,21).

The aim of this study, thus, is to perform a systematic review to explore the differences on emotional and anxiety responses to climate change (climate change anxiety) between different countries, and to classify the results according to the socioeconomic status of each studied country. To that end, this review considers quantitative and qualitative articles, in order to offset the expected reduced evidence available.

In this review, ecoanxiety and climate change anxiety are indistinctly used.

2. Material and Methods

This review was focused on articles that discussed anxiety-related emotional responses to climate change, specifically those that described worry or feelings of anxiety, regardless of whether they were measured using a scale or not. The articles considered were limited to those conducted within a predetermined country or geographical area.

For this study, the authors followed the PRISMA 2020 guidance (22,23) in order to get a qualitative systematic review. The steps are detailed next.

2.1. Inclusion and exclusion criteria

The articles were filtered according to the title, abstract, and full-text review. The screening was made according to the following criteria:

Title inclusion criteria:

- Include “climate change anxiety” (or related) in the title.
- Name “mental health” (or related) and “climate change” (or related) in the title.

Abstract inclusion criteria:

- Climate change anxiety (or equivalent) must be the main topic of the abstract.
- Abstract must name, at least, one country, region, or geographical area.

Full-text inclusion criteria:

- The article must specify in which country, region, or geographical area the study has been carried out.
- Climate change anxiety (or equivalent) must be the main topic of the article.
- Climate change is the main exposure for the study.

First, the articles were accepted for abstract screening if they met, at least, one title inclusion criteria. In the next step, only if the abstract met both inclusion criteria the article was considered to the full text review. In the last step, just those papers which met all the full-text inclusion criteria were accepted for this review.

2.2. Search strategy

The research of published literature was performed until November 2022. The articles were searched in PubMed, Scopus, Web of Science, and Cochrane. The search terms were the same for all databases: *"ecoanxiety" OR "climate change anxiety" OR "climate anxiety" OR "climate emotions" OR "climate worry" OR "climate change worry" OR "solastalgia" OR "ecological grief"* in combination with *"countries" OR "country" OR "communities" OR "community" OR "population" OR "nation" OR "regions" OR "sociodemographic" OR "geographic”* and filtered by title or abstract. Only articles written in English were considered. Individualized database search is detailed in the Supplementary material.

2.3. Study selection

The articles were independently reviewed by both authors. First, articles were filtered by title, then by abstract, and, finally, the full text was reviewed, according to the inclusion and exclusion criteria previously described.

The results of the selection of both reviewers were then compared. A consensus was reached between both authors for those articles in which existed disagreement on their inclusion. Those articles where the difference was not resolved were analyzed by a third reviewer who decided whether the article met or did not meet the inclusion criteria. Cohen's Kappa Concordance Index was calculated to assess reproducibility between the reviewers.

2.4. Data extraction

The data of the articles was first extracted by the main reviewer, and subsequently checked by the second one. To ease comparison, the detailed information about the extracted data was tabulated and schematically represented in a table. The results sought included changes on "mental health": climate change anxiety, mainly.

For each article which met inclusion criteria the following data were extracted: author, year of publication, country of study, study period, design and methodology, aim of the study, number of participants (N), participants' characteristics, method used to evaluate anxiety level (for example, which a scale was used, if any scale was utilized), questionnaire used, factors influencing experience of climate change, and ecoanxiety findings. This information is detailed in the Table 1 of the Supplementary material.

The missing data were not considered, given that it is qualitative systematic review.

2.5. Article evaluation

To minimize bias and increase the readers' trustworthiness of research, the articles were reviewed following the criteria proposed by Lincoln and Guba (24,25). In each article, four items were analyzed: i) credibility, the evidence given by the researcher to ensure that the results faithfully reflect what was studied; ii) transferability, contextual information given by the author such that readers can determine whether the results are applicable to their or other contexts; iii) dependability, the study process is explained in sufficient detail to be reproduced; and iv) confirmability, the researcher assures and demonstrates that the results are the consequence of the information extracted from the participants and not from the interpretation or bias of the author. Each item was rated on 0, 0.5 or 1, with overall rating hanging from 0 to 4 for each article.

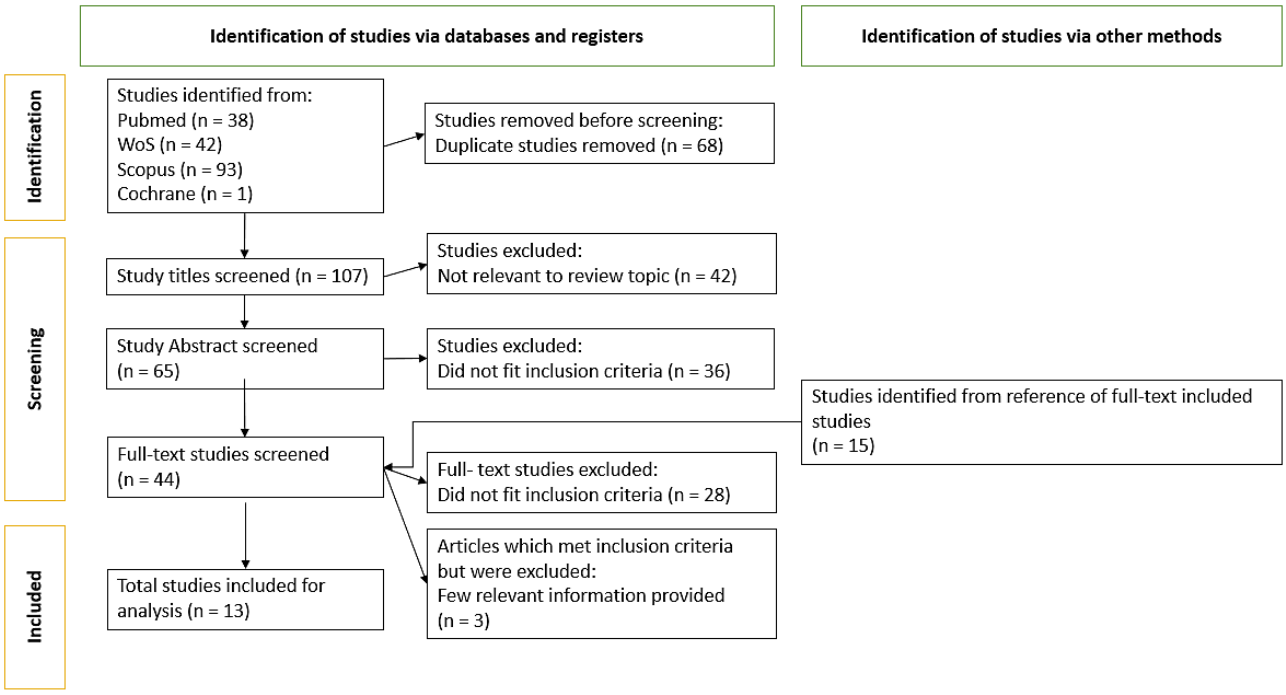
3. Results

3.1. Study characteristics

The research showed a total result of 174 articles. Thirty-eight results corresponded to PubMed, 93 results to Scopus, 42 results to Web of Science and 1 result to Cochrane. A total of 107 articles remained after duplicate papers were removed (n = 68). The articles which did not fit with the title inclusion criteria (n = 42) and the articles which did not meet abstract inclusion criteria (n = 36) were excluded. The remaining articles (n = 29) were fully text reviewed. Additionally, 15 articles were identified from reference of full text included studies and were also full text reviewed, making a total of 44 full text reviewed articles. Finally, 13 remaining articles were included in this review (Figure 1). Three articles which met inclusion criteria (26–28) were excluded due to poor relevant information provided on regard to the countries studied.

Cohen's kappa concordance index was κ = 0.56, indicating moderate agreement between both authors (29).

Figure 1. Article inclusion flow chart (PRISMA, 2020).



From the articles that conform this review (11,13,19,20,30–38), ten articles were published between 2020-2022 (11,13,19,20,30,31,34–37). Only three were published previously to 2020 (two in 2017 (32,38) and one in 2015 (33)). However, the period in which the studies were carried out varies from articles, being seven those which correspond to 2019-2022 period (13,19,20,34–37) and four to 2010-2019 period (11,31,33,38). The remaining studies did not specify any period (30,32). Most of the articles (77%) followed cross-sectional research (11,13,19,20,30–35), based on a

descriptive analysis from a survey or interview. The remaining articles followed a qualitative design based on semi-structured interviews (36–38). The detailed information is available in the Table 1 of the Supplementary material.

3.2. Synthesis results

The observed homogeneity was very high among the articles included regarding to their quality rating. All the articles received a 4/4 rate according to the credibility, transferability, dependability, and confirmability, previously explained (see '2.5. Article evaluation'), except one article (33) which was rated 3/4 (Table 1).

Table 1. Quality rating.

Climate change threats to family farmers' sense of place and mental wellbeing: A case study from the Western Australian Wheatbelt (38)	Credibility 1 Transferability 1 Dependability 1 Confirmability 1	4
A wise person plants a tree a day before the end of the world: coping with the emotional experience of climate change in Poland (37)	Credibility 1 Transferability 1 Dependability 1 Confirmability 1	4
Climate anxiety in children and young people and their beliefs about government responses to climate change: a global survey (19)	Credibility 1 Transferability 1 Dependability 1 Confirmability 1	4
Climate anxiety in Germany (13)	Credibility 1 Transferability 1 Dependability 1 Confirmability 1	4
Exploring Climate Emotions in Canada's Provincial North (36)	Credibility 1 Transferability 1 Dependability 1 Confirmability 1	4
Negative emotions about climate change are related to insomnia symptoms and mental health: Cross-sectional evidence from 25 countries (20)	Credibility 1 Transferability 1 Dependability 1 Confirmability 1	4
OK Boomer: A decade of generational differences in feelings about climate change (11)	Credibility 1 Transferability 1 Dependability 1 Confirmability 1	4
On climate anxiety and the threat it may pose to daily life functioning and adaptation: a study among European and African French-speaking participants (35)	Credibility 1 Transferability 1 Dependability 1 Confirmability 1	4
Prevalence and determinants of mental health related to climate change in Australia (34)	Credibility 1 Transferability 1 Dependability 1 Confirmability 1	4
Worrying about climate change: is it responsible to promote public debate? (33)	Credibility 1 Transferability 1 Dependability 0,5 Confirmability 0,5	3
Hope and Worry: Gendered Emotional Geographies of Climate Change in Three Vulnerable US Communities (32)	Credibility 1 Transferability 1 Dependability 1 Confirmability 1	4
The mental health impacts of climate change: Findings from a Pacific Island atoll nation (31)	Credibility 1 Transferability 1 Dependability 1 Confirmability 1	4
Farmer and rancher perceptions of climate change and their relationships with mental health (30)	Credibility 1 Transferability 1 Dependability 1 Confirmability 1	4

3.3. Thematic analysis

The main aim of most of the articles included in this review was to examine emotional responses to climate change in specific populations. Moreover, other purposes were: i) to examine the correlation of ecoanxiety with mental health and well-being (20,33); ii) to determine variables modifying climate change anxiety response (35); or iii) to analyze intergenerational response to climate change (11). To quantify climate anxiety, nine articles used scales (13,20,30,31,33–37); three of them (13,34,35), used the Climate Change Anxiety Scale (CCAS), a scale created to measure climate change anxiety and the cognitive and functional impairment related to it, developed by Clayton and Karazsia (39). However, most of the studies were based on a non-standardized questionnaire survey (19,30–32,35,38). The factors influencing experience of climate change were either multifactorial or dependent of the country or region of study.

3.3.1. Geographical analysis

The studies were carried out in countries according to the following distribution (Table 2): three in Australia (33,34,38); three in the United States (11,30,32); and one in each from Germany (13), Poland (37), Tuvalu (31), and Canada (36). Three more articles were multiple country studies (19,20,35). The first one (20) included 25 countries: Australia, Brazil, Canada, Chile, Finland, Germany, Italy, Netherlands, Norway, Portugal, Spain, and the United Kingdom (as Western countries); and China, Indonesia, Iran, Japan, Malaysia, Nigeria, Pakistan, Philippines, Romania, Russia, Slovakia, Tanzania, and Uganda (as non-Western countries); the second one (35) included 8 countries: France, Belgium, Switzerland, Gabon, Algeria, Rwanda, Morocco, and Congo; and the last one (19) included 10 countries: Australia, Brazil, Finland, France, India, Nigeria, Philippines, Portugal, United Kingdom, and the United States.

According to the Human Development Index (HDI) given by the United Nations Development Program (UNDP) (40) and the financial development status given by the World Bank (41), nine single country articles (11,13,30,32–34,36–38) corresponded to countries with very high human development index, all of them being high-income countries, and only one single country article (31) to a medium human developed country, a lower middle-income country, in this case (Table 2). No single country articles representing low human developed countries were found for this review.

From multiple country study articles (19,20,35), 32 countries corresponded to high or very high human developed countries (high-income, mostly), and 15 countries corresponded to medium or low human developed countries (Table 2).

Table 2. Country socioeconomic classification.

Article title	Country	HD Index	Financial Development
Climate change threats to family farmers' sense of place and mental wellbeing: A case study from the Western Australian Wheatbelt (38)	Australia	Very High HD	High-Income
Prevalence and determinants of mental health related to climate change in Australia (34)	Australia		
Worrying about climate change: is it responsible to promote public debate? (33)	Australia		
OK Boomer: A decade of generational differences in feelings about climate change (11)	United States		
Hope and Worry: Gendered Emotional Geographies of Climate Change in Three Vulnerable US Communities (32)	United States		
Farmer and rancher perceptions of climate change and their relationships with mental health (30)	United States		
Climate anxiety in Germany (13)	Germany		
A wise person plants a tree a day before the end of the world: coping with the emotional experience of climate change in Poland (37)	Poland		
Exploring Climate Emotions in Canada's Provincial North (36)	Canada		
The mental health impacts of climate change: Findings from a Pacific Island atoll nation (31)	Tuvalu	Medium HD	Lower Middle-Income
Climate anxiety in children and young people and their beliefs about government responses to climate change: a global survey (19)	Australia	Very High HD	High-Income
	Finland		
	France		
	Portugal		
	United Kingdom		
	United States		
	Brazil	High HD	Upper Middle-Income
	India	Medium HD	Lower Middle-Income
	Philippines		
	Nigeria	Low HD	
Negative emotions about climate change are related to insomnia symptoms and mental health: Cross-sectional evidence from 25 countries (20)	Australia	Very High HD	High-Income
	Canada		
	Chile		
	Finland		
	Germany		
	Italy		
	Netherlands		
	Norway		
	Portugal		
	Spain		
	United Kingdom		
	Japan		
	Romania		
	Slovakia		
	Malaysia		Upper Middle-Income
	Russia		
	Brazil	High HD	
	China		
	Indonesia		Lower Middle-Income
	Iran		
	Philippines	Medium HD	
	Nigeria	Low HD	
	Pakistan		
	Tanzania		
	Uganda		Low-Income
On climate anxiety and the threat it may pose to daily life functioning and adaptation: a study among European and African French-speaking participants (35)	France	Very High HD	High-Income
	Belgium		
	Switzerland		
	Gabon	High HD	Upper Middle-Income
	Algeria		Lower Middle-Income
	Congo	Medium HD	
	Morocco		
	Rwanda	Low HD	Low-Income

HD = Human Development

3.3.2. Climate change anxiety evaluation

Considering the HDI, all articles representing very high human development countries registered ecoanxiety (11,13,30,32–34,36–38). Three articles showed ecoanxiety rates above 30% of the participants in the respective studies (30,33,36), while only one article expressed ecoanxiety rate under 10% between the respondents (34). In addition, four articles showed ecoanxiety represented as qualitative findings (11,32,37,38) and one last article showed a mean score of 2.0 on CCAS (standard deviation: 1.2; in a range of 1 to 7, where higher scores means higher ecoanxiety levels) (13).

Only one single article represented medium human developed countries, with an ecoanxiety rate above 80% among respondents (31). However, three more articles had these countries in consideration (19,20,35), along with other type of countries. Two of them showed high ecoanxiety rates between the people surveyed (19,20) and one showed low ecoanxiety rates among the respondents (20).

In the same way, no single country articles representing low human developed countries were found in this review. Even so, the same three articles (19,20,35) considered low developed countries, proving high (19,20) and low (35) levels of ecoanxiety too.

In the event of considering the three multiple country articles (19,20,35), the conclusions for each one were the following: i) “Non-Western” countries reported higher rates of worry and impact on functioning than “Western” countries, showing an ecoanxiety rate of 60% between all respondents to the survey (19); ii) There was an inverse correlation between ecoanxiety and mental health, being stronger in “Western” countries (20); iii) There were not significant differences between African and European countries on ecoanxiety CCAS scores, with 11.64% of respondents reporting frequent ecoanxiety (35).

There were other common findings between the articles included in this review. In this way, four articles showed that younger participants tend to have higher rates of ecoanxiety (11,13,33,34), being considered young participants individuals aged 18-29 years old (13), 18-44 years old (34), and participants from iGeneration and Millennial generation (11). The other reference did not specify the age of participants considered to be young (33). In addition, two articles showed that female respondents express higher ecoanxiety rates than men (35,36).

The main ecoanxiety findings appear represented on Table 3.

Table 3. Climate change anxiety according to Human Development.

Article title	HD Index	Climate change anxiety findings	Observations
Climate change threats to family farmers' sense of place and mental wellbeing: A case study from the Western Australian Wheatbelt (38)	Very High HD	Respondents expressed worry about unpredictable weather conditions. Cumulative climate related place-based and chronic climatic adversity distress was also perceived by the participants	Local farmers. Not representative sample
Prevalence and determinants of mental health related to climate change in Australia (34)		9.37% (503/5370) of respondents had ecoanxiety feelings (CCAS). Youngest groups, socioeconomically disadvantaged, and those who had direct experience of climate change seem to have statistically significative higher CCAS rates	
Worrying about climate change: is it responsible to promote public debate? (33)		56% of respondents expressed worry about climate change; women, younger people, residents in capital cities, more educated people, and high income tended to worry more	
OK Boomer: A decade of generational differences in feelings about climate change (11)		All generations reported ecoanxiety feelings (worry, anger, guilt). Youngest generations' worry increased significatively over the years ($p<0.001$), compared to older generations	
Hope and Worry: Gendered Emotional Geographies of Climate Change in Three Vulnerable US Communities (32)		Ecoanxiety feelings (worry, sadness) were expressed by the participants, characteristically when thinking about future generations and traditional economic income sources	
Farmer and rancher perceptions of climate change and their relationships with mental health (30)		39.4% of respondents agreed that climate change was contributing to their stress level. Mean score was 2.27 (SD=0.67) on the modified GADS-7 scale (1 to 4) for climate anxiety. Climate risk perception correlated positively with climate anxiety symptoms	Local farmers. Not representative sample
Climate anxiety in Germany (13)		The mean score for CCAS was 2.0 (SD=1.2) among the respondents. Climate anxiety was higher between younger ($p<0.001$), full-time employed ($p<0.001$) and individuals without chronic conditions ($p<0.001$).	
A wise person plants a tree a day before the end of the world: coping with the emotional experience of climate change in Poland (37)		Participants felt anxiety-related emotions when thinking about climate change and the danger it poses. Other causes of ecoanxiety were the inevitability of its consequences and the expected human and biodiversity losses	
Exploring Climate Emotions in Canada's Provincial North (36)		More than 50% of the survey respondents indicated moderate and strong ecoanxiety responses. The most common responses between the participants were "worry" (82%) and "frustration" (71%). Females had significantly higher scores than males on the CES	
The mental health impacts of climate change: Findings from a Pacific Island atoll nation (31)	Medium HD	83.67% of the participants reported distress about abstract climate change stressors. This level of distress did not significantly differ from that reported about local climate stressors. 42.86% of the participants reported sadness and worry/anxiety and 79.27% reported to be somehow impaired on daily life. Low-income participants had significantly higher distress	
Climate anxiety in children and young people and their beliefs about government responses to climate change: a global survey (19)	Very High HD High HD Medium HD Low HD	60% of respondents expressed to be "very" or "extremely" worried (M=3.7 [1 to 5]; SD=1.7). 45% of respondents felt daily live functioning impairment. More than 50% reported feeling negative emotions: fear, sadness, anxiety, anger, powerless, helpless, and guilt. Philippines, India, and Brazil reported higher rates of worry and impact on functioning, compared to other Western countries (USA, UK, Finland)	Data from all countries is available. Participants aged 16-25
Negative emotions about climate change are related to insomnia symptoms and mental health: Cross-sectional evidence from 25 countries (20)	Very High HD High HD Medium HD Low HD	Negative climate emotions were positively correlated to insomnia symptoms ($p<0.001$) and inversely correlated with mental health ($p<0.001$), the latter being stronger in Western countries	Negative climate-related emotions data from all countries is available, but not analyzed
On climate anxiety and the threat it may pose to daily life functioning and adaptation: a study among European and African French-speaking participants (35)	Very High HD High HD Medium HD Low HD	11.64% of the participants reported frequent ecoanxiety and 20.72% showed functional impairment. No significant differences were found between African and European countries on cognitive-emotional and functional CCAS scores ($p>0.05$). Women and those experiencing direct climate change effects reported higher CCAS scores. CCAS scores were significantly positively correlated with pro-environmental behaviors	Data has been clustered in two groups ("European" countries and "African" countries)

HD = Human Development; CCAS = Climate Change Anxiety Scale; GADS-7 = Generalized Anxiety Disorder Scale-7; CES = Climate Emotions Scale; SD = standard deviation; M = mean score

4. Discussion

All the articles included in this review showed a certain degree of ecoanxiety (11,13,19,20,30–38). The spectrum of emotions expressed in this review was broad and complex, in part due to the ambiguity of the subject and the lack of consensus about how climate change anxiety is defined and measured (10). Ecoanxiety was identified as a response to climate change itself, to its inevitability, and to changes on climate patterns (11,33,36,37). Some people also expressed to feel worried about future generations, the viability of local income sources, traditional ways of living, and the expected human and biodiversity losses (32,37,38).

Developed countries showed moderate ecoanxiety rates that generally varied between 30%-60% of the participants (30,33,36). In the United States, people felt worried and sad about traditional income sources and future generations (32), showing that youngest generations' worry increased significatively over the years ($p<0.001$), compared to older generations (11). For Polish participants, the principal sources of anxiety were the dangers of climate change, especially when personal threat was expected, but nature- and human-related losses, and the inevitability of the consequences of climate change were also an important source of negative feelings (37). Meanwhile, in Australia, people from rural regions felt worried about unpredictable weather conditions and cumulative climate related place-based negative consequences, as well as repeated climatic adversity seemed to be a source of stress (38). In agreement with that, Berry et al. (33) observed that the 56% of Australian respondents expressed to be worried about climate change (33) and Galway et al. (36) concluded that more than 50% of Canadian respondents from the Provincial North region indicated moderate and strong ecoanxiety responses (82% of the participants expressed "worry" and 71% "frustration") (36). In contrast, Patrick et al. (34) observed that only 9.37% of respondents in Australia reported ecoanxiety according to the CCAS, with 10.24% of participants reporting cognitive-emotional effects and 12.85% of individuals reporting functional impairment on the respective CCAS subscales. This matches with the findings of Hajek et al. (13), who also found German participants showing low rates of ecoanxiety (13).

Medium and low developed countries were underrepresented in the literature available. One single country article was included from a medium developed country (31) and only 32% of the countries included in multiple country articles corresponded to these undeveloped countries. Medium developed countries were represented, in this case, by Tuvalu, a Polynesian, Pacific Atoll Island nation (31). People in Tuvalu, whose average elevation above the sea level is less than two meters, were aware that their home is at risk. An example of that is a phrase which has impregnated popular knowledge: "Tuvalu is sinking". In Tuvalu, 83.67% of respondents reported distress about abstract climate change stressors (42.86% of participants reported "sadness" and "worry/anxiety", while 72.27% of the interviewed reported to be somehow impaired on daily life) (31). This level of distress was similar to the level expressed by Tuvaluan for direct climate stressors (31).

Multiple country studies also represented less developed countries. Hickmann et al. (19) studied ten countries of which three were medium and low developed countries and also extremely high climate vulnerable countries (India, Philippines and Nigeria) (19). Almost 60% of the surveyed reported to be "very" or "extremely" worried about climate change, with a mean score of 3.7 on a 5-point scale (standard deviation = 1.7). The most frequent responses were fear (67.7%), sadness (66.7%), and anxiety (61.8%), with 75.5% of the respondents affirming that the future is frightening to them and 39.1% of participants doubting whether to have children in the future. In this regard, Hickman et al. (19) also observed how less developed countries tend to score higher levels of impact on functioning and worry (19).

In this way, a certain trend can be observed in the articles included in this review, where less developed countries score higher ecoanxiety rates, on average, compared with the most developed countries. Indeed, the highest ecoanxiety rate between the studies included in this review was from a medium developed country (31).

Nevertheless, Ogunbode et al. (20) found in their 25-country survey (with only five countries being medium and low developed countries) that negative climate-related-emotions were positively correlated with insomnia symptoms and negatively correlated with self-rated metal health, the latter being stronger in "Western" or most developed countries (20). While in the study developed by Heeren et al. (35) on eight French-speaking African and European countries, did not find significant differences on CCAS scores between African countries (some of which were less developed, like Congo, Morocco or Rwanda) and European developed countries (35). In agreement with Hajek et al. (13) and Patrick et al. (34), Heeren et al. (35) showed low rates of ecoanxiety (11.64% of respondents), with 20.72% of participants expressing negative functional impairment (35).

As it is seen, although a slight tendency can be perceived, there is not a clear consensus between the articles that conform this review. On the one side, most articles support the idea of higher ecoanxiety rates being in medium and low developed countries, rather than in developed countries (13,19,30,31,33,34,36); however, Ogunbode et al. (20) showed contrary findings to this idea. Meanwhile, Heeren et al. (35) did not find significant differences between countries with opposite development indexes.

In certain contexts, ecoanxiety research can be limited by people's awareness of climate change (10,42). Soutar et al. (10) already identified climate change conceptual understanding as a frequent limitation on ecoanxiety research. Mercado R. (42) concluded that those people who were aware of climate change positively correlated with distress, concern and individual risk perception. This is a major issue for research in lower developed countries, as people's access to scientific and media information is limited. For example, in rural India interviewers showed little understanding of scientific and technical terms like "climate change" and "global warming", yet they acknowledged to have experienced phenomenon of climate behavioral changes and understood those terms once they had been explained to them (22). Something similar was observed by Petheram et al. (43) to happen among Australian aboriginal people, where misconceptions of terms referred to climate change were noted.

Nonetheless, farmers from developed countries, who do not find that difficulty on term understanding, also express to be concerned about climate conditions (30,38). Western Australian Wheatbelt farmers felt worried about unpredictable weather conditions and expressed to be affected by cumulative and chronic climate adversity (38). In Montana (USA), 30.4% of requested farmer and ranchers agreed that climate change was a major contributor to their stress level (30). Indeed, climate risk perception correlated positively with their climate anxiety symptoms (30).

Although ecoanxiety might be affected by people's awareness of climate change and would be expected to be underrated in lower developed countries, other facts play an important role on climate change anxiety in the non-developed regions. Indeed, these non-developed countries are the most vulnerable to climate change impact, despite their contribution to climate change in greenhouse gas emissions being much lower than that from the developed countries (14,44,45). At the same time, people from rural areas are those who feel more attached to the land and whose way of living gets further disturbed by climate change (31,44,46–49). Beyond, place-based attachment, in addition to local environmental changes, can lead to a climate change emotion-related phenomenon known as solastalgia or ecological grief (50,51).

Besides, some articles of this review support previous research (5,6,12) with the idea of younger participants showing higher climate change anxiety rates (11,13,33,34). This issue is notable even in countries that showed lower ecoanxiety (13,34). These findings are remarkably important in a context where local environment affects children and adolescents' mental health (52), while 1 billon children (half of the children worldwide) live in countries considered to be at "extremely high-risk" of suffering the climate change impacts and almost every child worldwide (>99%) is exposed to at least one major climate or environmental hazard (53).

4.1. Limitations of the included papers

Some of the studies included in this review had small samples (30–32,37,38). This was in part due to the use of qualitative approach methods, to achieve a closer look at participants' feelings. In this case, small samples represented farmers (30,38), climate change vulnerable communities (32) or local communities (31,37). In relation with this, there were few articles which did not use validated scales for quantifying ecoanxiety prevalence among the studied population (11,19,32,38). From those articles which actually did use scales, the measuring tools used were the Climate Change Anxiety Scale (CCAS) (6,13,34,35), Plutchik's wheel of emotions (37,54), the Climate Emotion Scale (CES) (36), the State-Trait Anxiety Inventory (20,55), the Kessler 10-item Psychological Distress Scale (K10) (33,56), an adapted version of the 25-item Hopkins-Symptom Checklist (HSCL-25) (31), and the Generalized Anxiety Disorder Scale-7 (GADS-7) (30,57).

In addition, other frequent limitation was not to check participants' understanding of climate change phenomenon. Climate change is assumed to be known in cities and developed regions, but its knowledge might be lower in rural and non-developed areas. Thereby, people could not care about something whose existence remains unknown to them (10).

4.2. Limitations of the review process

In this review process, the existing heterogeneity on the presentation of the results (qualitative/quantitative articles, non-representative samples and different ecoanxiety measure tools) makes it difficult to compare findings between different countries.

However, the main limiting factor for the purpose of this review is the underrepresentation of countries with lower development, given that a great part of the literature available focuses on high-income countries (15). The vast proportion of studies identified in this review were conducted in Australia (19,20,33,34,38), the United States (11,19,30,32) and European countries (13,19,20,35,37), all of which represent developed countries. Meanwhile, medium and low human developed countries, altogether, represented only the 23% of the countries studied from the articles included in this review. Only one article from single country studies represented a medium developed country (31); and multiple country studies representation of low and medium developed countries reached only 32% (19,20,35).

Also, bias on the publication of the results should not be underestimated in the literature available (58).

4.3. Implications for future research

This review deepens on previous research about ecoanxiety, focusing on socioeconomic differences between countries and its relationship with the prevalence of climate change anxiety. It has been observed an important gap on the research of ecoanxiety in less developed countries. More research is needed in this way to solve underrepresentation of these undeveloped countries. Further, adaptation and mitigation measures taken to face climate change should consider this inequal representation to avoid exacerbating differences on the existing vulnerability between countries (14). Besides, accordance is needed to establish criteria which allow clear definition of climate change anxiety, as well as standardization on its measurement (10). The Climate Change Anxiety Scale developed by Clayton and Karazsia (6) may be a helpful measuring tool, as it is the most frequently used by authors in this review (13,34,35).

5. Conclusions

This systematic review reveals that people feel ecoanxiety and do concern about climate change in a large number of countries. Although there is not a clear consensus, there is a trend that may suggest that lower developed countries show higher ecoanxiety levels. However, underrepresentation of less developed countries on the literature exists. More research is needed to overcome the existing gap in low and middle developed countries.

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Supplementary material

A. Search strategies on online databases.

PubMed

(("ecoanxiety"[Title/Abstract] OR "climate change anxiety"[Title/Abstract] OR "climate anxiety"[Title/Abstract] OR "climate emotions"[Title/Abstract] OR "climate change worry"[Title/Abstract] OR "solastalgia"[Title/Abstract] OR "ecological grief"[Title/Abstract])) AND (("countries"[Title/Abstract] OR "country"[Title/Abstract] OR "communities"[Title/Abstract] OR "community"[Title/Abstract] OR "population"[Title/Abstract] OR "nation"[Title/Abstract] OR "regions"[Title/Abstract] OR "sociodemographic"[Title/Abstract] OR "geographic"[Title/Abstract]))

Web of Science

AB=((("ecoanxiety" OR "climate change anxiety" OR "climate anxiety" OR "climate emotions" OR "climate worry" OR "climate change worry" OR "solastalgia" OR "ecological grief")) AND (("countries" OR "country" OR "communities" OR "community" OR "population" OR "nation" OR "regions" OR "sociodemographic" OR "geographic”))

Scopus

TITLE-ABS-KEY (("ecoanxiety" OR "climate change anxiety" OR "climate anxiety" OR "climate emotions" OR "climate worry" OR "climate change worry" OR "solastalgia" OR "ecological grief") AND ("countries" OR "country" OR "communities" OR "community" OR "population" OR "nation" OR "regions" OR "sociodemographic" OR "geographic"))

Cochrane

(("ecoanxiety" OR "climate change anxiety" OR "climate anxiety" OR "climate emotions" OR "climate worry" OR "climate change worry" OR "solastalgia" OR "ecological grief")) AND (("countries" OR "country" OR "communities" OR "community" OR "population" OR "nation" OR "regions" OR "sociodemographic" OR "geographic”)) in Title Abstract Keyword - (Word variations have been searched)

B. Table 1. Data extracted from the included articles. Fragment 1.

Article	Author (ref)	Year of publication	Country of Study	Study period
1. Climate change threats to family farmers' sense of place and mental wellbeing: A case study from the Western Australian Wheatbelt (38)	Ellis NR, Albrecht GA	2017	Australia	2013-2014
2. A wise person plants a tree a day before the end of the world: coping with the emotional experience of climate change in Poland (37)	Zaremba D, Kulesza M, Herman AM, Marczak M, Kossowski B, Budziszewska M, Michałowski JM, Klöckner CA, Marchewka A, Wierzba M	2022	Poland	2021
3. Climate anxiety in children and young people and their beliefs about government responses to climate change: a global survey (19)	Hickman C, Marks E, Pihkala P, Clayton S, Lewandowski RE, Mayall EE, Wray B, Mellor C, van Susteren L	2021	10 countries (Australia, Brazil, Finland, France, India, Nigeria, Philippines, Portugal, United Kingdom, United States)	2021
4. Climate anxiety in Germany (13)	Hajek A, König HH	2022	Germany	March 2022
5. Exploring Climate Emotions in Canada's Provincial North (36)	Galway LP, Beery T	2022	Canada	2019
6. Negative emotions about climate change are related to insomnia symptoms and mental health: Cross-sectional evidence from 25 countries (20)	Ogunbode, CA, Pallesen, S., Böhm, G. et al.	2021	25 countries (Australia, Brazil, Canada, Chile, Finland, Germany, Italy, Netherlands, Norway, Portugal, Spain and the United Kingdom [as Western countries]; China, Indonesia, Iran, Japan, Malaysia, Nigeria, Pakistan, Philippines, Romania, Russia, Slovakia, Tanzania and Uganda [as non-Western countries])	Autumn 2019-Spring 2021
7. OK Boomer: A decade of generational differences in feelings about climate change (11)	Swim, JK; Aviste, R	2022	United States	2010-2019
8. On climate anxiety and the threat it may pose to daily life functioning and adaptation: a study among European and African French-speaking participants (35)	Heeren A, Mouguiama-Daouda C, Contreras A	2022	8 countries (France, Belgium, Switzerland, Gabon, Algeria, Rwanda, Morocco, Congo)	May-June 2021
9. Prevalence and determinants of mental health related to climate change in Australia (34)	Patrick R, Snell T, Gunasiri H, Garad R, Meadows G, Enticott J	2022	Australia	August-November 2020
10. Worrying about climate change: is it responsible to promote public debate? (33)	Berry HL, Peel D	2015	Australia	2013
11. Hope and Worry: Gendered Emotional Geographies of Climate Change in Three Vulnerable US Communities (32)	Du Bray M, Wutich A, Brewis A	2017	United States	
12. The mental health impacts of climate change: Findings from a Pacific Island atoll nation (31)	Gibson K, Barnett J, Haslam N, Kaplan I	2020	Tuvalu	August-October 2016
13. Farmer and rancher perceptions of climate change and their relationships with mental health (30)	Howard M, Ahmed S, Lachapelle P, Schure M B	2020	United States	

C. Table 1. Data extracted from the included articles. Fragment 2.

Article	Design and Methodology	Aim	Participants (N)	Participant characteristics
1. Climate change threats to family farmers' sense of place and mental wellbeing: A case study from the Western Australian Wheatbelt (38)	Community-based qualitative design; semi-structured interviews	To analyze the effect of climate change as a mental health stressor in farmer families of Australia	22	Gender (50% male, 50% female). Family farmers
2. A wise person plants a tree a day before the end of the world: coping with the emotional experience of climate change in Poland (37)	Qualitative research method; Individual semi-structured in-depth interviews	To examine emotional responses to climate change among Polish population	40	Gender (47.5% men, 52.5% women)
3. Climate anxiety in children and young people and their beliefs about government responses to climate change: a global survey (19)	Cross-sectional research design; Survey-based quantitative analysis; descriptive statistical analysis	To better understand response of youth to climate change on a large population sample	10000	Gender (51.4% male, 48.6% female). Age (mean age 20.82 years [SD 2.54])
4. Climate anxiety in Germany (13)	Cross-Sectional Study; Online-survey-based quantitative analysis	To better understand the level and the correlates of climate anxiety in Germany	3091	Age (18 to 74 years old)
5. Exploring Climate Emotions in Canada's Provincial North (36)	Exploratory quantitative design	To examine emotional responses to climate change in Canada's Provincial North	627	Age (adults over 18)
6. Negative emotions about climate change are related to insomnia symptoms and mental health: Cross-sectional evidence from 25 countries (20)	Cross-sectional questionnaire survey; quantitative research method	To examine correlation between adverse climate-related emotions and mental health in different national contexts	10143	Age (M = 23.4 years, SD = 7.3). Gender (females = 63.4%, males = 33.7%)
7. OK Boomer: A decade of generational differences in feelings about climate change (11)	Cross-sectional Study; Survey-based quantitative analysis	To analyze intergenerational differences on emotional response to climate change	22846	Age +18. Gender (49.5% men, 50.5% women. iGens and Millennials (M = 24 to 29); Generation X (M = 39 to 47); Baby Boomers (M = 54 to 64); Greatest and Silent generation (M = 72 to 80). SD (3.62 to 6.06).
8. On climate anxiety and the threat it may pose to daily life functioning and adaptation: a study among European and African French-speaking participants (35)	Cross-sectional Study; Descriptive statistical analysis	To determine variables modifying climate anxiety rate	2080	Gender (51.88% women, 48.12% men). Age (17 to 84 [M = 43.04, SD = 13.52]). Nationality (72.45% from France, 23.80% from Belgium, 1.54% from Switzerland, 0.82% from Gabon, 0.43% from Rwanda, 0.34% from Morocco, 0.34% from Algeria, 0.29% from Congo).
9. Prevalence and determinants of mental health related to climate change in Australia (34)	Cross-sectional Study; Online-survey-based quantitative analysis	To study the effects of climate change on Australian population's mental health	5483	Age 18+. Gender (women 60%, men 40%). Age (M = 52.71, SD = 19.96 years).
10. Worrying about climate change: is it responsible to promote public debate? (33)	Cross-sectional Study; Descriptive statistical analysis	To better understand correlation of climate change related emotions with mental health and well-being, regarding sociodemographic and place-based factors	6674	Age (M = 52.48 years, SD = 14.45). Gender (55.51% women, 41.94% men, 2.55% did not specify gender). Living place (58% regional towns or cities, 39% rural properties, 3% capital cities).
11. Hope and Worry: Gendered Emotional Geographies of Climate Change in Three Vulnerable US Communities (32)	Cross-sectional Study of Global Ethnohydrology Study, a multiyear, multisite study	To illustrate emotional response to climate change and its variation across different locations	103	Gender (female 51.5%, male 48,5%). Location (Mobile, Alabama, 30%; Kodiak, Alaska, 35%; Phoenix, Arizona 35%)
12. The mental health impacts of climate change: Findings from a Pacific Island atoll nation (31)	Cross-sectional study	To examine participants' response to different climate change stressors and its effect on daily functioning	100	Gender (male 50%)
13. Farmer and rancher perceptions of climate change and their relationships with mental health (30)	Case study, cross-sectional study	To study how climate change impacts on metal health among U.S. rural population	125	Age 18+

M = mean; SD = standard deviation.

D. Table 1. Data extracted from the included articles. Fragment 3.

Article	Anxiety evaluation	Questionnaire	Factors influencing experience of Climate change	Criteria of Quality	Quality rating
1. Climate change threats to family farmers' sense of place and mental wellbeing: A case study from the Western Australian Wheatbelt (38)		Non-standardized questionnaire	Sense of place	Credibility 1 Transferability 1 Dependability 1 Confirmability 1	4
2. A wise person plants a tree a day before the end of the world: coping with the emotional experience of climate change in Poland (37)	Plutchik's wheel of emotions (Plutchik, 2001)	Interview guide based on Marczak et al. (2022)	Central European polluter country; Poland's policy on climate change	Credibility 1 Transferability 1 Dependability 1 Confirmability 1	4
3. Climate anxiety in children and young people and their beliefs about government responses to climate change: a global survey (19)	Non-standardized questions	Non-standardized questionnaire	Impact of climate change; socioeconomic level	Credibility 1 Transferability 1 Dependability 1 Confirmability 1	4
4. Climate anxiety in Germany (13)	CCAS (Climate Change Anxiety Scale), by Clayton and Karazsia		Multifactorial	Credibility 1 Transferability 1 Dependability 1 Confirmability 1	4
5. Exploring Climate Emotions in Canada's Provincial North (36)	CES (Climate Emotion Scale); Climate emotions	36 questions, Likert scale	Region-dependent factors	Credibility 1 Transferability 1 Dependability 1 Confirmability 1	4
6. Negative emotions about climate change are related to insomnia symptoms and mental health: Cross-sectional evidence from 25 countries (20)	7-item index based on State-Trait Anxiety Inventory (Spielberger, 1983)	Single-item scale, Ontario Health Survey (Ahmad, Jhajj, Stewart, Burghardt, & Bierman, 2014); Bergen Insomnia Scale (Pallesen et al., 2008)	Country of origin	Credibility 1 Transferability 1 Dependability 1 Confirmability 1	4
7. OK Boomer: A decade of generational differences in feelings about climate change (11)	Non-standardized questions		Generation; temporal changes	Credibility 1 Transferability 1 Dependability 1 Confirmability 1	4
8. On climate anxiety and the threat it may pose to daily life functioning and adaptation: a study among European and African French-speaking participants (35)	Climate Change Anxiety Scale (CCAS; Clayton and Karazsia 2020)	Non-standardized questionnaire	Multifactorial	Credibility 1 Transferability 1 Dependability 1 Confirmability 1	4
9. Prevalence and determinants of mental health related to climate change in Australia (34)	11 item Climate Change Anxiety Scale (CCAS; Clayton and Karazsia, 2020)	PTSD-8 scale	Directly experienced climate change–related event	Credibility 1 Transferability 1 Dependability 1 Confirmability 1	4
10. Worrying about climate change: is it responsible to promote public debate? (33)	Kessler 10-item Psychological Distress Scale (K10; Kessler et al, 2003)		Sociodemographic and place-based factors	Credibility 1 Transferability 1 Dependability 0.5 Confirmability 0.5	3
11. Hope and Worry: Gendered Emotional Geographies of Climate Change in Three Vulnerable US Communities (32)		Non-standardized questionnaire	Climate-vulnerability	Credibility 1 Transferability 1 Dependability 1 Confirmability 1	4
12. The mental health impacts of climate change: Findings from a Pacific Island atoll nation (31)	Adapted version of 25-item Hopkins-Symptom Checklist	Non-standardized questionnaire	Self-reported climate change experience	Credibility 1 Transferability 1 Dependability 1 Confirmability 1	4
13. Farmer and rancher perceptions of climate change and their relationships with mental health (30)	Generalized Anxiety Disorder Scale-7 (GADS-7)	Non-standardized questionnaire	Rural area	Credibility 1 Transferability 1 Dependability 1 Confirmability 1	4

"We are at a beginning of a mass extinction and all you can talk about is about money and fairy tales of eternal economic growth. ¡How dare you! You are failing us, but the young people are starting to understand your betrayal. The eyes of all future generations are upon you and if you choose to fail us, I say: We will never forgive you.

We will not let you get away with this. Right here, right now, is where we draw the line. The world is waking up and change is coming, whether you like it or not."

Greta Thunberg, 2019 UN climate action summit in New York