



On climate anxiety and the threat it may pose to daily life functioning and adaptation: a study among European and African French-speaking participants

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Abstract

The notion of climate anxiety has gained traction in the last years. Yet uncertainty remains regarding the variations of climate anxiety across demographic characteristics (e.g., gender, age) and its associations with adaptive (i.e., pro-environmental) behaviors. Moreover, the point-estimate proportion of people frequently experiencing climate anxiety has seldom been probed. In this study, we assessed climate anxiety (including its related functional impairments), along with demographic characteristics, climate change experience, and pro-environmental behaviors, in 2080 French-speaking participants from eight African and European countries. 11.64% of the participants reported experiencing climate anxiety frequently, and 20.72% reported experiencing daily life functional consequences (e.g., impact on the ability to go to work or socialize). Women and younger people exhibited significantly higher levels of climate anxiety. There was no difference between participants from African and European countries, although the sample size of the former was limited, thus precluding any definite conclusion regarding potential geographic differences. Concerning adaptation, climate anxiety was associated with pro-environmental behaviors. However, this association was significantly weaker in people reporting frequent experiences of climate anxiety (i.e., eco-paralysis) than in those with lower levels. Although this observation needs to be confirmed in longitudinal and experimental research, our results suggest that climate anxiety can impede daily life functioning and adaptation to climate change in many people, thus deserving a careful audit by the scientific community and practitioners.

Keywords Climate anxiety · Climate change anxiety · Climate change · Anxiety · Eco-anxiety

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1 Introduction

There is increasing awareness that climate change poses one of the most significant threats to human health and well-being (Cissé et al. 2022; Trewin et al. 2021). On these grounds, a growing body of research has pointed to climate change's current and potential consequences on mental health (Cissé et al. 2022; Clayton 2020). For instance, there is already substantial evidence of the impact of climate-related extreme weather on mental health, notably via increased post-traumatic stress disorder, depression, and substance abuse among people who have experienced flooding, wildfires, or hurricanes (for a review, see Charlson et al. 2021). Likewise, although more gradual, drought can impair mental health, especially among workers impacted by its consequences (e.g., farmers; Carleton 2017).

Alongside these consequences, a small but growing empirical literature has revealed the experience of climate anxiety (aka eco-anxiety), in the sense of apprehension and worry about the potential scope of the anticipated impacts of climate change and the uncertainty of their specific nature, timing, and precise location, even among people who have not personally experienced any direct impact (Clayton 2020; Cunsolo et al. 2020). This emerging literature also aligns with worldwide media attention about climate anxiety (Clayton 2020) and recent reports of spikes of online searches about it in the general community (Cunsolo et al. 2020).

At the empirical level, several national polls have accordingly pointed to climate change as a rising source of anxiety and stress in the general community (e.g., American Psychological Association, 2020; Reser et al. 2012). However, most of these surveys varied the way they assessed climate anxiety and related phenomena, with delineations ranging from anxiety feelings related to anthropogenic climate change to a generalized sense that the ecological foundations of the existence are on the brink of collapsing (for discussion, see Coffey et al. 2021). Such variations render particularly challenging the comparison across studies, thus thwarting any comparison across groups, geographic locations, and time (for a discussion, see Coffey et al. 2021).

To tackle these issues, Clayton and Karazsia (2020) recently developed and validated a 13-item scale to measure climate anxiety, the Climate Anxiety Scale (CAS). This 5-point Likert-type scale relies upon items adapted from previous surveys about climate anxiety wherein adaptation was grounded in existing clinical measures of functional impairments and rumination. The resulting scale has two subscales. One assesses cognitive-emotional features of climate anxiety through items like “I found myself crying because of climate change.” The other subscale taps onto the functional impairments and aims at assessing whether thinking about climate change has undermined respondents' ability to socialize, work, or concentrate at work or school with items like “My concerns about climate change interfere with my ability to get work or school assignments done” or “My concern about climate change makes it hard for me to have fun with my family or my friends” (Clayton 2020; Clayton and Karazsia 2020).

In two US sample studies ($n_1 = 197$; $n_2 = 199$), Clayton and Karazsia (2020) found that about a fifth of their samples exhibited cognitive and emotional features of climate anxiety, as denoted by 17–19% of the respondents with a mean score higher than the scale-midpoint on the cognitive-emotional subscale. Most strikingly, they also found that about a quarter of their respondents reported a degree of climate anxiety interfering with their ability to function, as reflected by 26–27% of the respondents with a mean score higher than the scale-midpoint on the functional impairments' subscale. Such

levels of functional impairments thus point to climate anxiety as a potential threat to well-being, deserving a thorough audit by mental health experts.

Of critical importance, prior research suggests that climate anxiety might not be equally distributed among people. First, women might be more vulnerable to climate change impact (Cissé et al. 2022; World Health Organization 2014), notably because of their perceived relative lack of power when facing a threat in many cultures (World Health Organization 2014). Moreover, gender difference can also be seen through women's negligible participation in decision-making structures and limited access to and control of agricultural lands, inputs, and services as resources to foster their adaptation to climate change (Aguilar, 2008). Yet, several cross-national studies showed that women engage more in pro-environmental behavior than men (e.g., Allen et al. 2019; Hunter et al. 2004). Moreover, prior research on the psychological impact of climate change has pointed to gender differences, with women reporting more concern and distress than men in response to climate change (e.g., Searle and Gow, 2010; Zelezny et al., 2000). However, although these phenomena are conceptually close to climate anxiety, gender differences in climate anxiety have seldom been investigated. To our best knowledge, only two studies examined this question. In two US samples, Clayton and Karazsia (2020) found no gender differences in climate anxiety per se but only gender differences in pro-environmental behaviors. In contrast, Wullenkord et al (2021) found that, in a German-speaking sample, women reported more climate anxiety than men. As such, a critical step would thus be to clarify whether gender difference in climate anxiety varies across cultures and geographic locations.

Second, prior national polls and surveys have shown that young adults experience higher levels of climate anxiety (e.g., Clayton and Karazsia, 2020). For instance, Clayton and Karazsia (2020) reported that the youngest US adults (aged between 18 and 35 years old) scored higher than the older ones on both the cognitive-emotional and functional subscales of the Climate Anxiety Scale. A recent survey conducted among young adults (between 16 and 25 years old) from around the globe corroborated that climate change particularly impairs this group's psychological and social functioning, notably because of their perception that their future is doomed (Hickman et al. 2021).

Third, early reports have also suggested that those directly affected by climate change in their local environment experience higher levels of anxiety vis-à-vis climate change. For instance, in a study conducted in the Pacific Island atoll nation of Tuvalu, 95% of the participants reported experiencing considerable anxiety about climate change, with this latter interfering in their daily life functioning in 87% of the cases (Gibson et al. 2020). In the same vein, climate anxiety had a medium-sized correlation with participants' reported experience of climate change in US samples (Clayton and Karazsia 2020). However, to the best of our knowledge, this link has never been explored across more diverse and culturally different samples.

Finally, one of the most critical questions in today's climate anxiety research is whether this latter may prompt adaptive behavioral responses vis-à-vis climate change. Several Australian and British studies reported an association between climate anxiety and pro-environmental behaviors (e.g., Reser et al. 2012; Verplanken et al. 2020). Likewise, in a large US sample, people who reported climate anxiety identified themselves as more motivated to change their behavior than those who did not (American Psychological Association 2020). However, participants were only assessed regarding their motivation to change their behavior, not their actual behaviors. Moreover, prominent views on the emotional responses to climate change hold that climate anxiety might actually inhibit people from taking real behavioral action (Albrecht 2011), a notion termed "eco-paralysis" (Albrecht 2011). However, in Clayton and Karazsia's (2020) study, pro-environmental behaviors

were neither positively nor negatively associated with climate anxiety. As such, uncertainty still abounds regarding how and when climate anxiety may or not trigger adaptive responses' deployment (for a discussion, see Pihkala 2020). From a basic anxiety research framework, one may even wonder whether this effect of “eco-paralysis” may not only be at play among individuals with high levels of climate anxiety, an observation that would align with prominent views of the maladaptive—i.e., no longer adaptive—nature of anxiety in people with anxiety disorders (e.g., Öhman 2008).

Therefore, we had three goals in this study. First, we aimed at examining how age, gender, educational background, previous experience of climate change, and geographical locations impact climate anxiety. Of particular interest was to capitalize on Clayton and Karazsia (2020)'s recent conceptualization of climate anxiety and their dissociation between climate anxiety's cognitive-emotional and functional features. Adopting similar operationalization can ease more stringent between-study comparisons and ultimately facilitate cumulative science regarding climate anxiety across geographic locations. The geographical location was reflected here by various countries sharing the same language—i.e., French— but relying on very different cultural backgrounds and geographic regions (e.g., European and African French-speaking countries). Because ongoing and long-term consequences of climate change are significantly more adverse for people living in African countries than in European countries, notably in terms of human health and safety, food and water security, and socio-economic development (e.g., Collier et al. 2008; World Meteorological Organization 2020), we anticipated between-country differences regarding climate anxiety. Second, we followed Clayton and Karazsia (2020) to estimate the proportions of people reporting “frequent” (i.e., more than sometimes) climate anxiety to allow a more stringent comparison with prior research. Of particular interest was better understanding the demographic characteristics, climate change experience, and pro-environmental behaviors of these individuals. Finally, we dared to examine whether individuals with lower values of climate anxiety would be more prone to deploy adaptive behavioral responses vis-à-vis climate change than those with higher levels or, in other words, whether people with higher levels of climate anxiety would show higher levels of eco-paralysis.

2 Method

2.1 Participants

We recruited 2080 French-speaking participants, wherein 51.88% ($n=1079$) were women and 48.12% ($n=1001$) men. Participants were recruited from the general community via online social media and listserv advertisements. The data collection took place from May 2021 to July 2021. Participants were between the age of 17 and 84 ($M=43.04$, $SD=13.52$). Regarding nationality, 72.45% ($n=1507$) were from France, 23.80% ($n=495$) from Belgium, 1.54% ($n=32$) from Switzerland, 0.82% ($n=17$) from Gabon, 0.43% ($n=9$) from Rwanda, 0.34% ($n=7$) from Morocco, 0.34% ($n=7$) from Algeria, and 0.29% ($n=6$) from Congo. Their years of education completed since primary school ranged from 0 to 21 ($M=16.77$, $SD=2.71$).

The study was approved by the Institutional Review Board and conducted according to the Declaration of Helsinki. Each participant provided written informed consent before completing the survey.

2.2 Measures

2.2.1 Climate anxiety

We assessed climate anxiety using the Climate Anxiety Scale (CAS; Clayton and Karazsia 2020). The CAS is a 13-item self-report questionnaire wherein participants rate each on a 5-point Likert-type scale, from 0 (*never*) to 5 (*almost always*). For each item, a higher score reflects a greater endorsement of the content covered by the item. Although one may compute a total scale score (e.g., Clayton 2020; Clayton and Karazsia 2020), the scale also includes two subscales: (a) eight items measuring the cognitive and emotional impairments of climate anxiety (e.g., “Thinking about climate change makes it difficult for me to concentrate”; “I found myself crying because of climate change”) and (b) five items measuring the functional impairments (e.g., “My concerns about climate change interfere with my ability to get work or school assignments done,” “My concern about climate change makes it hard for me to have fun with my family or my friends”). We used the validated French version of the scale (Mouguiama-Daouda et al. 2022). As in previous studies (e.g., Clayton and Karazsia 2020), the internal reliability of CAS was high in the present sample, with a Cronbach’s alpha of 0.89 for the global scale score (0.81 for the cognitive-emotional impairments subscale and 0.82 for the functional impairments one).

To align with Clayton and Karazsia (2020) and ease future between-studies comparison, we computed, for each participant, mean scores for the CAS total scale score and the mean score for each of the two subscales (i.e., cognitive-emotional and functional impairment of climate anxiety).

2.2.2 Experience with climate change

Following Clayton and Karazsia (2020), we assessed the experience of climate change via three items (i.e., “I have been directly affected by climate change”; “I know someone who has been directly affected by climate change”; “I have noticed a change in a place that is important to me due to climate change”). Each item was assessed using a 5-point Likert-type scale, ranging from 0 (*never*) to 5 (*almost always*). We used the validated French version of these items (Mouguiama-Daouda et al., 2022) with a Cronbach’s alpha of 0.78, and items’ internal reliability was good in the present sample. We computed a scale mean score for each participant.

2.2.3 Pro-environmental behaviors

We measured participants’ engagement in pro-environmental behaviors using the five items (e.g., “I try to reduce my behaviors that contribute to climate change,” “I feel guilty if I waste energy”; “I turn off lights”) proposed by Clayton and Karazsia (2020). Each item was assessed using a 5-point Likert-type scale, ranging from 0 (*never*) to 5 (*almost always*). We used the validated French version of these items (Mouguiama-Daouda et al. 2022), and their internal reliability was acceptable in the present sample, with a Cronbach’s alpha of 0.69. For each participant, we computed a scale mean score.

2.3 Statistical procedures

We examined potential differences between men and women through separated independent sample *t*-tests. Because of limited participants for some countries, we collapsed the different countries into African and European countries, respectively, to maximize statistical power. Potential differences between African and European countries were also assessed through independent sample *t*-tests.

We tested whether climate anxiety was associated with age, education, the experience of climate change, as well as pro-environmental behavioral engagement via separate zero-order Pearson product-moment correlations. Values of 0.10, 0.30, and 0.50 or larger are respectively considered benchmarks for small, medium, and large associations (Cohen 1988).

Using a strategy similar to that of Clayton and Karazsia (2020), we operationalized individuals reporting low and high climate anxiety by computing the percentage of participants with a CAS mean score below and above the midpoint of the scale (i.e., reporting experiencing climate anxiety less or more than “sometimes,” respectively). Because of our interest in distinguishing the cognitive-emotional from the functional features of climate anxiety, we also applied a similar procedure to each subscale of the CAS. Independent sample *t*-tests were then used to probe potential differences between people below and above the midpoint value for continuous variables and reported effect sizes in the form of Cohen’s *d*. Cohen’s *d* values lower than 0.3, around 0.5, and larger than 0.8 are considered benchmarks for small, medium, and large effect sizes (Kotrlík et al. 2011). For categorical variables, we implemented χ^2 tests and reported effect sizes in the form of ϕ . A value of $\phi=0.1$ depicts a small effect, 0.3 a medium effect, and 0.5 a large effect (Kotrlík et al. 2011).

Finally, to test whether the association between climate anxiety and pro-environmental behaviors differs between individuals with a mean score below and above the midpoint, we compared each group’s zero-order Pearson product-moment correlations via Fisher’s *r*-to-*z* transformations. We implemented a similar approach for examining potential differences in the association between experience of climate change and climate anxiety between people below and above the midpoint.

Due to the size of our sample and the number of variables, we only reported findings of *t* and χ^2 tests that are significant at the $p < 0.005$ to be confident that our results are genuine (Ioannidis 2018). Likewise, we implemented a Bonferroni correction for the 21 correlations examined to account for potential type I error.

3 Results

3.1 Differences between geographic locations

There were no significant differences between participants from African and European countries (see Table S1 in the Supplementary Materials section).

3.2 Gender differences

Women scored significantly higher than men on the CAS mean score as well as the cognitive-emotional subscale. However, there was no significant difference regarding the functional subscale. Moreover, pro-environmental behaviors were significantly higher in women than men. Results are in Table 1.

Table 1 Climate anxiety and other features as a function of gender

	Female (<i>n</i> = 1079)	Male (<i>n</i> = 1001)	<i>t</i>	<i>p</i>	Cohen's <i>d</i>
CAS, M (SD)	2.12 (.69)	1.99 (.70)	3.89^a	<.001	.19
Cognitive-emotional impairments, M (SD)	2.09 (.70)	1.89 (.66)	6.72^a	<.001	.29
Functional impairments, M (SD)	2.15 (.81)	2.16 (.91)	.35 ^a	.73	.01
Experience of climate change, M (SD)	2.26 (.99)	2.15 (.98)	2.54 ^a	.01	.11
Pro-environmental behaviors, M (SD)	4.19 (.48)	3.95 (.62)	9.89^a	<.001	.43

CAS Climate Anxiety Scale (Clayton and Karazsia, 2020), *M* mean score, *SD* standard deviation. Significant differences appear in bold (at $p < .005$)

^aValue for *t* (2078)

3.3 Associations with age and education

Age had a small, but significant negative correlation with the CAS mean score and with both the cognitive-emotional and functional scores. Regarding education, none of the correlations were significant. All the correlations are shown in Table 2.

3.4 Associations with experience of climate change

As shown in Table 2, the experience of climate change had significant positive small-to-medium correlations with the CAS mean score, as well as with both cognitive-emotional and functional scores.

Table 2 Correlations between climate anxiety, age, years of education, experience of climate change, and pro-environmental behaviors

	1	2	3	4	5	6
1. Age	—					
2. Education	.02	—				
3. Climate anxiety	−.15**	.02	—			
4. Cognitive-emotional impairments	−.16**	<.01	.94**	—		
5. Functional impairments	−.11**	.03	.90**	.71**	—	
6. Experience of climate change	.06	.04	.35**	.34**	.31**	—
7. Pro-environmental behaviors	−.06	.03	.41**	.39**	.37**	.26**

CAS Climate Anxiety Scale (Clayton and Karazsia, 2020). Significant correlations appear in bold

** $p < .001$ (with Bonferroni-corrected adjustment for multiple comparisons)

3.5 Associations with pro-environmental behaviors

The CAS score significantly and positively correlated with participants' pro-environmental behaviors. Similar findings stood out for the cognitive-emotional and functional subscales. Note that pro-environmental behaviors were also significantly associated with the experience of climate change. All these correlations were small-to-medium sized. Results appear in Table 2.

3.6 Proportions of individuals reporting frequent climate anxiety

From our entire sample, 11.64% of the participants scored higher than the midpoint of the CAS mean score or, in other words, experienced climate anxiety more often than "sometimes." When applying a similar procedure to the mean score of the cognitive-emotional and functional subscales, the proportions were 10.82% and 20.72%, respectively.

We also examined potential differences between individuals with a score below and above the midpoint of the CAS mean score. As shown in Table 3, those above the midpoint were significantly younger, more behaviorally engaged, and reported significantly higher levels of climate change experience, with all these differences being of moderate-to-large effect size (Cohen's d between 0.49 and 0.68). However, there were no significant differences in gender, education, and countries between those above and below the midpoint.

Similar patterns of observations emerged when comparing those below and above the midpoint on the cognitive-emotional and functional subscales (see Table S2 and S3 in the Supplementary Materials section). The only exception was for gender, wherein there were significantly more women (i.e., 14.1% of the entire sample) than men (i.e., 7.3%) among those scoring above the midpoint for the cognitive-emotional (see Table S2 in the supplementary materials).

Table 3 Participants' characteristics as a function of their levels of climate anxiety

	Overall sample (n = 2080)	Below the midpoint (n = 1838)	Above the midpoint (n = 242)	t or χ^2	p	Cohen's d or ϕ
Age, M (SD)	43.04 (13.52)	43.76 (13.60)	37.57 (11.46)	6.77^a	< .0001	.49
Gender (%)						
Female	51.88%	51.2 ^c	43.00 ^c	2.68 ^b	.10	.04
Male	48.12%	48.8 ^c	57.00 ^c			
Years of education	16.77 (2.71)	16.77 (2.73)	16.76 (2.58)	.08 ^a	.94	< .01
CAS, M (SD)	2.06 (.70)	1.89 (.56)	3.30 (.31)	38.53^a	< .0001	3.12
Cognitive-emotional impairments, M (SD)	2.00 (.69)	1.84 (.56)	3.16 (.40)	35.36^a	< .0001	2.71
Functional impairments, M (SD)	2.16 (.86)	1.98 (.72)	3.52 (.55)	32.17^a	< .0001	2.40
Location (%)				.03 ^d	.87	< .01
European countries (n = 2034)	97.79%	88.3% ^e	11.7% ^e			
African countries (n = 46)	2.21%	89.1% ^e	10.9% ^e			
Experience of climate change, M (SD)	2.20 (.99)	2.13 (.97)	2.79 (.96)	10.04^a	< .001	.68
Pro-environmental behaviors, M (SD)	4.07 (.56)	4.04 (.57)	4.37 (.46)	8.70^a	< .001	.64

CAS Climate Anxiety Scale (Clayton & Karazia, 2020), M mean score, SD standard deviation. Significant differences (at $p < .005$) appear in bold

^aValue for $t(2078)$

^bValue for $\chi^2 (1, N = 2080)$

^cValue reflecting % within each gender category

^dValue reflecting % within each location

3.7 Associations between climate anxiety, pro-environmental behaviors, and experience of climate change as a function of climate anxiety levels

The CAS mean score correlated significantly more strongly ($Z=3.96$, $p<0.001$) with pro-environmental behaviors in people scoring below the CAS midpoint ($r=0.40$, $p<0.0001$) than those above ($r=0.15$, $p=0.02$). Similar observations stood out for the association between pro-environmental behaviors and the cognitive-emotional subscale ($Z=3.92$, $p<0.001$) as well as with the functional scores ($Z=4.28$, $p<0.001$). Regarding climate change experience, there was no significant difference between groups. Results are presented in Table 4.

A very similar pattern of findings emerged when comparing those with a mean score below and above the midpoint on either the cognitive-emotional or functional subscales. Results are available in the Supplementary Materials (see Table S4 and S5).

4 Discussion

The aims of this study were three-fold. First, we aimed at assessing the relationship between climate anxiety with gender, age, educational background, previous experience of climate change, and geographical locations. A second goal was to determine the *point-estimate* proportions of people reporting “frequent” (i.e., more than sometimes) climate anxiety to ease comparison with prior US research. Finally, we also aimed to examine the relations between climate anxiety and pro-environmental behaviors.

Perhaps the most striking observation was that 11.64% of the participants experienced climate anxiety more often than “sometimes” and that this proportion was 10.82% and 20.72% when distinguishing the cognitive-emotional and the functional climate anxiety-related impairments, respectively. In other words, our findings suggest that a substantial proportion of people shows a degree of climate anxiety that impedes their ability to function in their daily life (e.g., impact on the ability to go to work or socialize). Of particular interest, these proportions were comparable, though slightly lower, to those reported in two US samples, wherein the proportions were 17–19% for the cognitive-emotional impairments and 26–27% for the functional impairments (Clayton and Karazsia 2020). Because functional impairments in daily life often yield further harming mental health outcomes (e.g., McKnight and Kashdan 2009), our findings point to climate anxiety as a potential threat deserving a careful audit by the mental health experts.

Moreover, several variables were either associated with climate anxiety or among those characterizing people with higher levels of climate anxiety. A first key observation across our results was that women exhibit significantly higher levels of climate anxiety than men. This finding dovetails with the World Health Organization (2014) and Intergovernmental Panel on Climate Change’s (Cissé et al. 2022) concern that women might be more emotionally vulnerable to climate change, notably because of the relative perceived lack of power associated, in many countries and cultural backgrounds, with female gender roles when facing natural threats (Aguilar 2008; Cissé et al. 2022; World Health Organization 2014).

However, although our observation of women’s higher levels of climate anxiety fully aligns with the only previous study relying on the CAS in non-US samples (i.e., Germany; Wullenkord et al. 2021), it departs from prior research conducted in the USA (i.e., Clayton

Table 4 Associations between climate anxiety and pro-environmental behaviors and experience of climate change as a function of participants' levels of climate anxiety

	Below the midpoint (n = 1838)	Above the midpoint (n = 242)	Z	p (2-tailed)
CAS and pro-environmental behaviors	.40**	.15*	3.96	< .001
Cognitive-emotional impairments and pro-environmental behaviors	.38**	.13*	3.92	< .001
Functional impairments and pro-environmental behaviors	.34**	.06	4.28	< .001
Experience of climate change and CAS	.30**	.23**	1.10	.27
Experience of climate change and cognitive-emotional impairments	.28**	.23*	.78	.44
Experience of climate change and functional impairments	.25**	.08	2.55	.01
Experience of climate change and pro-environmental behaviors	.25**	.11	2.11 ^a	.03

CAS Climate Anxiety Scale (Clayton and Karazsia, 2020). Significant differences between groups (at $p < .005$) appear in bold

** Denotes correlations significant at $p < .005$ (with Bonferroni-corrected adjustment for multiple comparisons)

and Karazsia 2020). Strikingly, since we found no gender difference between participants from European and African countries in the present study, and that climate change is, to some extent, culturally constructed (Clayton 2020), one may thus wonder whether cultural differences in gender perceptions and response to climate change may explain such a discrepancy between US and non-US samples. Cross-cultural research has pointed to strong gender-culture interaction regarding the lived experience of climate change as a threat, with substantial variations between men and women regarding their lived experience of the perceived changes in the local ecology, loss of economic opportunity, and implications for the future generations (e.g., Du Bray et al. 2019). An essential step in future research would thus be to explore the daily life experience of climate anxiety in women from various cultural backgrounds.

On the other hand, since anxiety and related disorders are approximately twice as common in women as in men (e.g., McLean et al. 2011), one may wonder whether the gender difference reported in this study does not merely mirror gender differences in general anxiety and depression. Likewise, prior research has pointed to gender differences in emotional intelligence, especially in women's higher ability to identify and express their emotions (e.g., Meshkat and Nejati 2017). As such, one may wonder whether women might not merely be better at noticing and reporting their emotional experiences vis-à-vis climate change than men. On the other hand, in line with prior research (e.g., Clayton and Karazsia 2020; Hunter et al. 2004), we found that women have more pro-environmental behaviors than men, an observation suggesting that the gender difference is not limited to emotional features but also included behaviors. A critical next step in future iterations would thus be to assess whether gender difference in climate anxiety remains when controlling for general anxiety, depression, and emotional intelligence.

Consistent with prior US research on climate anxiety (e.g., Clayton and Karazsia 2020; Hickman et al., 2021), we also evidenced that younger were more impacted than older adults. And this observation is not surprising. There is mounting evidence that adolescents and young adults are increasingly worried about and functionally burdened by climate change because of their perception that their future is doomed and their feelings of betrayal and abandonment by adults and governments that are failing to react appropriately (Hickman et al. 2021). As pointed out by several mental health experts (e.g., Crandon et al. 2022; Vergunst and Berry 2021), increasing their empowerment as a key stakeholder group, representative of the world's future adults, may help lessen the burden of climate change in this group. Encouraging school-based programs to build agency and facilitating family and community support may also help foster climate change resilience in youths (Crandon et al. 2022).

Another key observation was that the perceived experience of climate change was strongly associated with all the climate anxiety-related features, though there were no significant differences between African and European countries in terms of climate anxiety. Moreover, people scoring above the scale-midpoint reported significantly higher experiences of climate change than those below. In other words, this pattern of findings suggests that the personal experience of climate change might be more decisive vis-à-vis climate anxiety than the geographic locations per se. This observation echoes with other reports pointing to the importance of the perceived changes in the local environment in the emotional responses to climate change (du Bray et al. 2019; Ellis and Albrecht 2017; Middleton et al. 2021). Should the existence of a direct link between the perceived experience of climate change and climate anxiety be confirmed, one may wonder about a potential increase in the prevalence rates of climate anxiety, given that climate change is having more and more visible consequences worldwide (e.g., Trewin et al. 2021; World Meteorological Organization 2020).

Finally, in line with prior research (e.g., Reser et al. 2012; Verplanken et al. 2020), there were moderate-to-strong associations between climate anxiety features and pro-environmental behaviors. As such, climate anxiety may thus prompt individual behavioral responses vis-à-vis climate change. Of note, this observation echoes with the assumed (evolutionary) adaptive nature of anxiety as an emotion. Indeed, anxiety is a future-oriented emotion characterized, at the cognitive level, by the anticipation of a possible danger that is not present and may never occur (e.g., worry about a potential and uncertain threat; Öhman 1996) and, at the physiological level, by physical tension and chronic over-arousal (e.g., muscle tension) thought as reflecting readiness for dealing with a future danger should it occur (Heeren 2020; Öhman 1996). At the behavioral level, anxiety may thus foster a strong tendency to deploy behavioral responses aiming to avoid the occurrence of the anticipated threat. From this perspective, anxiety's adaptive value may allow planning and preparing for a possible threat.

Interestingly, one of our most striking observations emerged when comparing people with higher climate anxiety levels to those with lower levels. First, the former described themselves as more behaviorally engaged in pro-environmental behaviors than those with lower scores. But, we also found that the association between climate anxiety and pro-environmental behaviors depends upon the severity of climate anxiety. People with higher levels of climate anxiety exhibited significantly lower correlations with pro-environmental behaviors than those with lower levels of climate anxiety. And this pattern of observations should not come as a surprise. From an anxiety research framework, when anxiety turns to be excessive or severe, it may not only impair daily functioning and cause psychological distress but may also no longer serve its adaptive purpose. Thus, our results suggest that similar conclusions might apply to climate anxiety. These results also echo the notion of "eco-paralysis" (Albrecht 2011), where people become so anxious about climate change that it inhibits them from taking real behavioral action—a phenomenon, sometimes misinterpreted as apathy (Usher et al. 2019; see also the notion of "total inertia," Cianconi et al. 2021).

However, the link between climate change anxiety and pro-environmental behaviors requires further advancement, especially regarding its causal and temporal unfolding. An especially decisive step will be to elucidate the psychological mechanisms bridging climate anxiety and pro-environmental behaviors. So far, research has pointed to coping strategies—i.e., a set of constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands, when these demands are appraised as taxing or exceeding the resources of the person" (Lazarus and Folkman 1984, p. 141)—has a potential candidate bridging the emotional experience vis-à-vis climate change, including climate anxiety, and pro-environmental behaviors (Brosch 2021; Mah et al. 2020; Ojala et al. 2021). However, coping strategies encompasses varying processes (Zimmer-Gembeck and Skinner 2016), arising from both the individual (e.g., emotion, motivation, attention, cognition) and the collective levels (e.g., cooperative action to mitigate stressors; for a discussion, see Lyons et al. 1998). A significant challenge will thus be to examine the respective and joint influences of these different levels of coping strategies in the relationship between climate anxiety and pro-environmental behaviors (e.g., Mah et al. 2020).

The present study may yield implications. Given our observation of a substantial proportion of participants experiencing climate anxiety levels that threaten their daily life functioning, actionable efforts are required (for a discussion, see Cunsolo et al. 2020). First, because anxiety is assumed to be triggered when facing an unpredictable possible future-oriented threat, the communication strategy of the governments' representatives should not only communicate about climate change per se but also about the national plan

to anticipate adaptation to the many challenges posed by climate change (for discussion, see Mah et al. 2020; Moser 2017). Of note, several initiatives about communicating climate change adaptation, anxiety, and resilience offer online resources to do so (e.g., APA Task Force on Climate Change; Climate Psychology Alliance). Second, mental health practitioners should carefully audit and follow up climate anxiety in their practice. Although clinical research on climate anxiety is still at an early stage, research has pointed to treatment options tapping into nature contact and connectedness as up-and-coming tools to alleviate climate anxiety and foster adaptation to climate change (for a review, see Baudon and Jachens 2021). Moreover, research has also emphasized empowerment—encouraging people with climate anxiety to engage in conservation actions—as a beneficial treatment option (e.g., Baudon and Jachens 2021; Cunsolo et al. 2020). Recent research also shows that environmental activism may buffer the mental health consequences of climate anxiety (e.g., Schwartz et al. 2022). By helping people with severe climate anxiety engage in collective actions, clinical researchers and social workers may foster a cascade of downstream benefits, combating feelings of hopelessness and promoting community connection and social support (for a discussion, see Schwartz et al. 2022).

The present study has limitations that deserve careful consideration in future iterations. First, one of our study's main limitations is that we relied on a cross-sectional research design. Although we aimed at easing the comparison across studies (e.g., Clayton and Karazsia 2020; Wullenkord et al. 2021), such a cross-sectional approach precludes any potential cause-effect relationships between our variables of interest (e.g., Muraige et al., 2013). And this is unfortunate since anxiety-related phenomena, such as the ones described here, fluctuate over time (e.g., Blanchard et al. 2022; Heeren et al. 2015). For instance, one may wonder about the temporal unfolding of the relation between climate anxiety's cognitive-emotional and functional features (e.g., does the onset of functional impairments require the precedence of cognitive and emotional impairments?). A second major shortcoming is the limited number of participants from African countries, precluding any definite conclusions regarding the absence of differences between geographic locations. On the other hand, neither the *p*-values nor the effect sizes were close to meaningful values when comparing African and European countries. Future iterations may thus want to replicate this study in larger and more culturally diverse African samples. Third, we relied on the CAS, while recent research has suggested that this scale has limitations (e.g., Wullenkord et al. 2021), including its focus on the maladaptive nature of anxiety, as compared to the possible practical nature of anxiety (for a discussion, see Pihkala 2022). Likewise, other scales assessing climate anxiety have been published since we initiated this project. For instance, Hogg et al. (2021) recently developed a 13-item scale encompassing four factors (i.e., affective symptoms, rumination, behavioral symptoms, and anxiety about one's negative impact on the planet). A critical next step would thus be to examine whether the present findings replicate when using other measurements tools. Fourth, we assessed pro-environmental behaviors through the self-reported items developed by Clayton and Karazsia (2020). Although we aimed at ensuring the standardization of the measurement approach across studies, these items are restricted to individual behaviors and do not cover collective actions (e.g., environmental activism). This is unfortunate given prior research linking climate anxiety to collective actions (e.g., Schwartz et al. 2022; Stanley et al. 2021). Finally, although climate anxiety has been seen as distinct from other sources of anxiety (e.g., COVID-19; Kulcar et al. 2022), one may wonder whether those with higher levels of climate anxiety exhibit higher threat reactivity, regardless of the nature of the threat.

Notwithstanding these limitations, the present findings suggest that climate anxiety may impede the daily life functioning of a large proportion of people. Moreover, although climate

anxiety may foster behavioral adaptation to climate change, it may block it in people with severe climate anxiety. Thus, the development of interventions helping those with severe climate anxiety will be a critical next step to lessen the threat it may pose to our adaptation.

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Data availability The anonymized data and the supplementary materials are available on the Open Science Framework at the following repository link: <https://osf.io/g2cre/>.

Declarations

Conflict of interest The authors declare no competing interests.

References

- Aguilar L (2008) Is there a connection between gender and climate change? International Union for Conservation of Nature (IUCN), Office of the Senior Gender Adviser
- Albrecht G (2011) Chronic environmental change: emerging ‘psychoterratic’ syndromes. In: Weissbecker I. (eds) *Climate Change and Human Well-Being*. International and Cultural Psychology. Springer, New York. https://doi.org/10.1007/978-1-4419-9742-5_3
- Allen E, Lyons H, Stephens JC (2019) Women’s leadership in renewable transformation, energy justice and energy democracy: redistributing power. *Energy Res Soc Sci* 57:101233. <https://doi.org/10.1016/j.erss.2019.101233>
- American Psychological Association (2020) *Stress in America*. Stress in America Survey TM. <https://www.apa.org/news/press/releases/stress/2020/report-october>
- Baudon P, Jachens L (2021) A scoping review of interventions for the treatment of eco-anxiety. *Int J Environ Res Public Health* 18(18):9636. <https://doi.org/10.3390/ijerph18189636>
- Blanchard MA, Contreras A, Kalkan RB, Heeren A (2022) Auditing the research practices and statistical analyses of the group-level temporal network approach to psychological constructs: a systematic scoping review. *Behav Res Methods*. <https://doi.org/10.3758/s13428-022-01839-y> (Advanceonlinepublication)
- Brosch T (2021) Affect and emotions as drivers of climate change perception and action: a review. *Curr Opin Behav Sci* 42:15–21. <https://doi.org/10.1016/j.cobeha.2021.02.001>
- Carleton TA (2017) Crop-damaging temperatures increase suicide rates in India. *Proc Natl Acad Sci USA* 114(33):8746–8751. <https://doi.org/10.1073/pnas.1701354114>
- Charlson F, Ali S, Benmarhnia T, Pearl M, Massazza A, Augustinavicius J, Scott JG (2021) Climate change and mental health: a scoping review. *Int J Environ Res Public Health* 18(9):4486. <https://doi.org/10.3390/ijerph18094486>
- Cianconi P, Hanife B, Grillo F, Zhang K, Janiri L (2021) Human responses and adaptation in a changing climate: a framework integrating biological, psychological, and behavioural aspects. *Life* 11(9):895. <https://doi.org/10.3390/life11090895>
- Cissé G, McLeman R, Adams H, Aldunce P, Bowen K, Campbell-Lendrum D, Clayton S, Ebi KL, Hess J, Huang C, Liu Q, McGregor G, Semenza J, Tirado MC (2022) Health, wellbeing, and the changing structure of communities. In: Pörtner H-O, Roberts DC, Tignor M, Poloczanska ES, Mintenbeck K, Alegría A, Craig M, Langsdorf S, Löschke S, Möller V, Okem A, Rama B (eds.) *Climate Change 2022: Impacts, Adaptation, and Vulnerability*. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press. In Press

- Clayton S (2020) Climate anxiety: psychological responses to climate change. *J Anxiety Disord* 74:102263. <https://doi.org/10.1016/j.janxdis.2020.102263>
- Clayton S, Karaszia B (2020) Development and validation of a measure of climate change anxiety. *J Environ Psychol* 69:101434. <https://doi.org/10.1016/j.jenvp.2020.101434>
- Coffey Y, Bhullar N, Durkin J, Islam MS, Usher K (2021) Understanding eco-anxiety: a systematic scoping review of current literature and identified knowledge gaps. *J Clim Change Health* 100047. <https://doi.org/10.1016/j.joclim.2021.100047>
- Cohen J (1988) *Statistical power analysis for the behavioral sciences*. Routledge Academic, New York
- Collier P, Conway G, Venables T (2008) Climate change and Africa. *Oxf Rev Econ Policy* 24(2):337–353. <https://doi.org/10.1093/oxrep/grn019>
- Crandon TJ, Scott JG, Charlson FJ et al (2022) A social–ecological perspective on climate anxiety in children and adolescents. *Nat Clim Chang* 12:123–131. <https://doi.org/10.1038/s41558-021-01251-y>
- Cunsolo A, Harper SL, Minor K, Hayes K, Williams KG, Howard C (2020) Ecological grief and anxiety: the start of a healthy response to climate change? *Lancet Planet Health* 4(7):e261–e263. [https://doi.org/10.1016/S2542-5196\(20\)30144-3](https://doi.org/10.1016/S2542-5196(20)30144-3)
- du Bray M, Wutich A, Larson KL, White DD, Brewis A (2019) Anger and sadness: gendered emotional responses to climate threats in four island nations. *Cross-Cult Res* 53(1):58–86. <https://doi.org/10.1177/1069397118759252>
- Ellis N, Albrecht G (2017) Climate change threats to family farmers’ sense of place and mental wellbeing: a case study from the Western Australian Wheatbelt. *Soc Sci Med* 175:161–168. <https://doi.org/10.1016/j.socscimed.2017.01.009>
- Gibson KE, Barnett J, Haslam N, Kaplan I (2020) The mental health impacts of climate change: findings from a Pacific Island atoll nation. *J Anxiety Disord* 73:102237. <https://doi.org/10.1016/j.janxdis.2020.102237>
- Heeren A (2020) On the distinction between fear and anxiety in a (post)pandemic world: a commentary on Schimmenti et al. (2020). *Clinical Neuropsychiatr* 17:189–191. <https://doi.org/10.36131/cnfioritieditore20200307>
- Heeren A, Philippot P, Koster EHW (2015) Impact of the temporal stability of preexistent attentional bias for threat on its alteration through attention bias modification. *J Behav Ther Exp Psychiatry* 49:69–75. <https://doi.org/10.1016/j.jbtep.2014.10.012>
- Hickman C, Marks E, Pihkala P, Clayton S, Lewandowski RE, Mayall EE, ... van Susteren L (2021) Climate anxiety in children and young people and their beliefs about government responses to climate change: a global survey. *Lancet Planet Health* 5: e863–73. [https://doi.org/10.1016/S2542-5196\(21\)00278-3](https://doi.org/10.1016/S2542-5196(21)00278-3)
- Hogg TL, Stanley SK, O’Brien LV, Wilson MS, Watsford CR (2021) The Hogg Eco-Anxiety Scale: development and validation of a multidimensional scale. *Glob Environ Chang* 71:102391. <https://doi.org/10.1016/j.gloenvcha.2021.102391>
- Hunter LM, Hatch A, Johnson A (2004) Cross-national gender variation in environmental behaviors. *Soc Sci Q* 85:677–694. <https://doi.org/10.1111/j.0038-4941.2004.00239.x>
- Ioannidis J (2018) The proposal to lower P value thresholds to 005. *JAMA* 319(14):1429–1430. <https://doi.org/10.1001/jama.2018.1536>
- Kotrlik JW, Williams HA, Jabor MK (2011) Reporting and interpreting effect size in quantitative agricultural education research. *J Agri Educ* 52(1):132–142. <https://doi.org/10.5032/jae.2011.01132>
- Kulcar V, Siller H, Juen B (2022) Discovering emotional patterns for climate change and for the COVID-19 pandemic in university students. *J Clim Change Health* 100125. Advance online publication. <https://doi.org/10.1016/j.joclim.2022.100125>
- Lazarus, RS, Folkman S (1984) *Stress, appraisal, and coping*. Springer publishing company
- Lyons RF, Mickelson KD, Sullivan MJL, Coyne JC (1998) Coping as a communal process. *J Soc Pers Relat* 15(5):579–605. <https://doi.org/10.1177/0265407598155001>
- Mah AY, Chapman DA, Markowitz EM, Lickel B (2020) Coping with climate change: three insights for research, intervention, and communication to promote adaptive coping to climate change. *J Anxiety Disord* 75:102282. <https://doi.org/10.1016/j.janxdis.2020.102282>
- Meshkat M, Nejati R (2017) Does emotional intelligence depend on gender? A study on undergraduate English majors of three Iranian universities, *SAGE Open*. <https://doi.org/10.1177/2158244017725796>
- McKnight PE, Kashdan TB (2009) The importance of functional impairment to mental health outcomes: a case for reassessing our goals in depression treatment research. *Clin Psychol Rev* 29(3):243–259. <https://doi.org/10.1016/j.cpr.2009.01.005>
- McLean CP, Asnaani A, Litz BT, Hofmann SG (2011) Gender differences in anxiety disorders: prevalence, course of illness, comorbidity and burden of illness. *J Psychiatr Res* 45(8):1027–1035. <https://doi.org/10.1016/j.jpsychires.2011.03.006>
- Middleton J, Cunsolo A, Pollock N, Jones-Bitton A, Wood M, Shiwak I, Flowers C, Harper SL (2021) Temperature and place associations with Inuit mental health in the context of climate change. *Environ Res* 198:111166. <https://doi.org/10.1016/j.envres.2021.111166>

- Moser SC (2017) Communicating c. In: Oxford Encyclopedia on Climate Change Communication, M. Nisbet, ed., Oxford University Press. <https://doi.org/10.1093/acrefore/9780190228620.013.436>.
- Mouguiama-Daouda C, Blanchard MA, Coussement C, Heeren A (2022) On the measurement of climate change anxiety: French validation of the Climate Anxiety Scale. *Psychologica Belgica* 62(1):123–135. <https://doi.org/10.5334/pb.1137>
- Ohman A (1996) Preferential preattentive processing of threat in anxiety: Preparedness and attentional biases. In: Rapee RM (ed) *Current controversies in the anxiety disorders*. Guilford Press, New York, pp 253–290
- Öhman A (2008) Fear and anxiety: overlaps and dissociations. In: Lewis M, Haviland-Jones JM, Barrett LF (eds) *Handbook of emotions*. The Guilford Press, pp 709–728
- Ojala M, Cunsolo A, Ogunbode CA, Middleton J (2021) Anxiety, worry, and grief in a time of environmental and climate crisis: a narrative review. *Annu Rev Environ Resour* 46:35–58. <https://doi.org/10.1146/annurev-environ-012220-022716>
- Pihkala P (2020) Anxiety and the ecological crisis: an analysis of eco-anxiety and climate anxiety. *Sustainability* 12(19):7836. <https://doi.org/10.3390/su12197836>
- Pihkala P (2022) Commentary: Three tasks for eco-anxiety research - a commentary on Thompson et al. (2021). *Child and adolescent mental health* 27(1):92–93. <https://doi.org/10.1111/camh.12529>
- Reser JP, Bradley GL, Glendon AI, Ellul MC, Callaghan R (2012) Public risk perceptions, understandings, and responses to climate change and natural disasters in Australia and Great Britain, Gold Coast, Australia: National Climate Change Adaptation Research Facility
- Schwartz SE, Benoit L, Clayton S, Parnes MF, Swenson L, Lowe SR (2022) Climate change anxiety and mental health: environmental activism as buffer. *Curr Psychol*, 1-14. <https://doi.org/10.1007/s12144-022-02735-6>
- Searle K, Gow K (2010) Do concerns about climate change lead to distress? *Int J Clim Change Strategies Manage* 2(4):362–379. <https://doi.org/10.1108/17568691011089891>
- Zimmer-Gembeck MJ, Skinner EA (2016) The development of coping: implications for psychopathology and resilience. In D. Cicchetti (Ed.), *Developmental psychopathology: Risk, resilience, and intervention* (pp. 485–545). John Wiley & Sons, Inc. <https://doi.org/10.1002/9781119125556.devpsy410>
- Stanley S, Hogg T, Leviston Z, Walker I (2021) From anger to action: differential impacts of eco-anxiety, eco-depression, and eco-anger on climate action and wellbeing. *The Journal of Climate Change and Health* 1:100003. <https://doi.org/10.1016/j.joclim.2021.100003>
- Trewin B, Cazenave A, Howell S, Huss M, Isensee K, Palmer MD, ... , Vermeulen A. (2021) Headline indicators for global climate monitoring. *Bull Am Meteorol Soc* 102, 20-37. <https://doi.org/10.1175/BAMS-D-19-0196.1>
- Usher K, Durkin J, Bhullar N (2019) Eco-anxiety: how thinking about climate change-related environmental decline is affecting our mental health. *Int J Ment Health Nurs* 28(6):1233–1234. <https://doi.org/10.1111/inm.12673>
- Vergunst F, Berry HL (2021) Climate change and children’s mental health: a developmental perspective. *Clinical Psychological Science*. <https://doi.org/10.1177/21677026211040787>
- Verplanken B, Marks E, Dobromir AI (2020) On the nature of eco-anxiety: how constructive or unconstructive is habitual worry about global warming? *J Environ Psychol* 72:101528. <https://doi.org/10.1016/j.jenvp.2020.101528>
- World Health Organization (2014) Gender, climate change and health. World Health Organization. https://apps.who.int/iris/bitstream/handle/10665/144781/9789241508186_eng.pdf
- World Meteorological Organization (2020) State of the global climate 2020. WMO-No. 1264. https://library.wmo.int/index.php?lvl=notice_display&id=21880#.YWwkRy2FDY
- Wullenkord MC, Tröger J, Hamann KRS, Loy LS, Reese G (2021) Anxiety and climate change: a validation of the Climate Anxiety Scale in a German-speaking quota sample and an investigation of psychological correlates. *Clim Change* 168:3. <https://doi.org/10.1007/s10584-021-03234-6>
- Zelezny LC, Chua P, Aldrich C (2000) Elaborating on gender differences in environmentalism. *J Soc Issues* 56:443–457. <https://doi.org/10.1111/0022-4537.00177>

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