

# Not just anxious: validating the French Inventory of Climate Emotions and exploring climate emotions profiles among young adults

Arnaud Sapin<sup>1\*</sup>, Susan Clayton<sup>2</sup>, Anaïs Ameline<sup>1</sup>, Ghazlane Fleury-Bahi<sup>1</sup>

<sup>1</sup> Nantes Université, LPPL UR 4638, 44300 Nantes, France

<sup>2</sup> College of Wooster, Department of Psychology, Wooster (Ohio), United States of America

\* Corresponding author:

- Institutional address: Laboratoire de Psychologie des Pays de la Loire, Faculté de Psychologie, Nantes Université, Chemin de la Censive du Tertre, 44300 Nantes, France
- Phone: +33781293434
- Email: [arnaud.sapin@univ-nantes.fr](mailto:arnaud.sapin@univ-nantes.fr)
- ORCID : <https://orcid.org/0000-0001-9149-8112>

## DATA AVAILABILITY AND PREREGISTRATION STATEMENT

This psychometric study was not specifically pre-registered but is mentioned in the more general preregistration of the survey from which the study is a part of. It is available here (in Analysis Plan section – please also note that the project originally included an American data collection which could not be achieved):

[https://osf.io/yw96q/?view\\_only=e0e4b09322ec4c5b874967b6f1c1b9fc](https://osf.io/yw96q/?view_only=e0e4b09322ec4c5b874967b6f1c1b9fc)

All the data and the R code used to perform the analyses are available here: [https://osf.io/huvf5/?view\\_only=d7b52e2092744769acd692847fba3e41](https://osf.io/huvf5/?view_only=d7b52e2092744769acd692847fba3e41)

## ACKNOWLEDGMENTS

The authors would like to thank Joanna Gautier and Celia Northam for the work of translation/back-translation they carried out. The authors would also like to thank the respondents, without whom this study would not have been possible.

## ETHICAL APPROVAL AND INFORMED CONSENT STATEMENTS

The study and its materials were evaluated and approved by the Ethics, Deontology, and Scientific Integrity Committee of Nantes Université (approval no. 29112024). All participants gave their informed consent before completing the questionnaire, and all data were aggregated afterward to ensure anonymity. Participants were not remunerated.

## CONTRIBUTION STATEMENT

A-S, G-FB, A-A, and S-C contributed to the study design. Data collection and data analysis was conducted by A-S. A-S wrote the main manuscript under

the supervision of G-FB, A-A and S-C. All authors reviewed and contributed to the final version of the manuscript.

#### **CONFLICT OF INTEREST STATEMENT**

The authors declare that there are no conflicts of interest related to the content of this article.

#### **FUNDING STATEMENT**

This work is part of the doctoral research project of A-S, funded by Nantes Université. No additional funding was received to support this study.

## **Abstract**

While several French-language scales assess climate anxiety, no tool currently captures the broader spectrum of climate emotions. Yet the emotional experience of the environmental crisis is multidimensional and requires nuanced measurement. To address this issue, the Inventory of Climate Emotions (ICE) has been developed and validated in several Western countries. Such tool opens up numerous research opportunities, including the search for distinct profiles of climate change experiences. Therefore, this study aimed to validate the French version of the ICE and explore its potential in identifying emotional patterns among a large sample of young French people (18 to 30 years old, N=1650). Psychometric analysis revealed good sensitivity, acceptable reliability and satisfactory indicators for several validity aspects (structural, convergent, divergent, nomological) - although powerlessness and hope showed consistently weaker indices. The Latent Profile Analysis conducted to identify emotional patterns revealed four distinct profiles, including three "atypical" ones (hostile, angry and affected) which showed significant associations with gender, political orientation or connectedness to nature. This study thus provides a validated instrument assessing climate emotions in French-speaking contexts, with potential applications across a wide range of interventions and research settings - including, but not limited to, the study of climate emotion profiles.

**Keywords** : Climate Emotions ; Psychometric Evaluation ; French Language ; Latent Profile Analysis ; Emotional patterns

# 1. INTRODUCTION

The environmental crises that societies are starting to face represent a relatively unprecedented threat in human history. Indeed, climate change (IPCC, 2022) and its manifestations (rising temperatures, extreme weather events and biodiversity loss) will have major consequences for human and non-human life for centuries to come. Hence, the stakes are twofold: on one hand, the climate crisis is a major health issue, jeopardizing the mental and physical health of individuals (Clayton et al., 2017; Hayes et al., 2018; McMichael et al., 2006) ; On the other hand, it implies major systemic changes at both institutional and individual levels (IPCC, 2022). Whether we want to promote people's health or their behavioral transition, taking into account their perception of the environment is critical.

## 1.1 Climate anxiety...or rather, climate emotions?

In recent decades, psychology researchers have explored the relationship between the individual and the environment in a number of ways (Fleury-Bahi et al., 2017) : quality of life, pro-environmental behavior, risk perception, etc. Among the various concepts developed in the discipline, climate emotions<sup>1</sup> have gained considerable prominence in recent years. Numerous theoretical contributions have helped to define the shape of this construct, notably the pioneering work of Albrecht (2005, 2011) on psychoterratic illnesses or studies regarding environment-related pre- and post-traumatic stress disorders (Kaplan, 2020; Lowe et al., 2013). Nevertheless, it's probably the term “climate anxiety” that has emerged the most, both in the literature and in society as a whole (Pihkala, 2020b), a concept that can be defined as the “chronic fear of environmental doom”(Clayton et al., 2017). A series of symptoms have been associated with this intense fear of the consequences of climate change, including

---

<sup>1</sup> We chose to use “climate emotion / climate anxiety” but the reader should note that “eco-emotion / eco-anxiety is also rather common. This choice is based on the terminology used in the translated scale. We would also argue, based on prior qualitative studies, that most individuals do not (perhaps due to a not sufficient level of knowledge) have distinct emotions between the global environmental crisis and phenomena specifically related to climate change, and therefore that there is a massive conceptual overlap. For a discussion of the differences/similarities between the terminologies, see Cianconi et al. (2023).

mood alterations, sleep disorders and eating disorders (Berry et al., 2018; Jalin et al., 2024; Ogunbode et al., 2021).

In our view, the symptom-approach of climate anxiety is essential but not sufficient to describe people's relationship with the environment. Indeed, while a significant number of individuals experience significant distress related to environmental issues (Ágoston, Csaba, et al., 2022; Reyes et al., 2021), this remains a minority compared to the portion of the population who feel concern, worry or fear without experiencing severe symptoms. And as several authors pointed out (Ágoston, Csaba, et al., 2022; Kleres & Wettergren, 2017; Nairn, 2019; Sapin et al., 2025), it is key to take into account a broader range of emotions surrounding climate change to have a better understanding of this rich and multifaceted emotional experience.

Climate emotions, described as affective phenomena significantly linked to ecological issues (Pihkala, 2022), have been the subject of considerable scientific interest. Several authors helped clarifying their conceptualization (Cianconi et al., 2023; Landmann, 2020; Pihkala, 2022). These studies have shed light on the specific features and characteristics of each climate emotion. Feelings associated with anxiety (fear, worry, dread) have been described as existential feelings that encapsulate our individual and collective projection into the future. The feeling of powerlessness, linked to individuals' perceived lack of agency, is described as an integral part of anxiety (Pihkala, 2020a, 2020b). There are also emotions related to sadness (sorrow, grief, solastalgia), which are characterized as the response to the perception (whether reactive or anticipated) of all the losses (human lives, cultural heritage, flora and fauna) caused by the environmental crisis. Sadness is therefore very associated with our empathy and connectedness to nature (Cunsolo & Ellis, 2018; Sapin et al., 2025; Tschakert et al., 2019). We could mention guilt as well, where we make a moral judgment about ourselves ("self-condemning emotions", Landmann, 2020) ; or anger which has an even stronger moral dimension. Indeed, anger is usually a feeling directed towards something or someone identified as responsible, making it an emotion that reflects the individual's

worldview, values, and ideology (Stanley et al., 2021; van Zomeren et al., 2010). Finally, the case of hope is particularly interesting, considering that it is a particularly complex feeling. Ojala's work (2012) distinguishes two types of hope: constructive hope, referring to the belief in individual and collective agency and hope based on denial, which can be characterized as a techno-solutionism. Hence, hope is also a moral and existential emotion, as it stems both from our worldview and the way we envision the future. Like climate anxiety, climate emotions have been associated with different levels of mental health (Pitt et al., 2023) and behavioral commitment to the environment (Caillaud et al., 2019; Sampaio et al., 2023; Stanley et al., 2021) which highlights the need for valid measurement of these constructs.

## **1.2 The methodological aspects of measuring climate emotions**

The dynamism of climate anxiety research in recent years has led to multiple methodological initiatives. Indeed, there have been numerous published validated scales to measure climate anxiety and its symptoms: the Climate Anxiety Scale (Clayton & Karazsia, 2020), the Hogg Eco-Anxiety Scale (Hogg et al., 2021) or the Eco-Anxiety Questionnaire (Ágoston et al., 2022). Subsequently, these scales were validated in French (Mathé et al., 2025; Micoulaud-Franchi et al., 2024; Mouguiama-Daouda et al., 2022) and complemented by new scales developed in this language (Jalin et al., 2025). Some of these authors went beyond anxiety, as in the case of Ágoston et al. who proposed a triad of scales for eco-anxiety, eco-guilt and eco-grief. However, none of these instruments was designed to measure most of the climate emotions widely studied in the literature in one scale; and it is this gap that the Inventory of Climate Emotions (ICE) aimed to fill.

The ICE developed by Marczak et al. (2023) provides the measurement of 8 climate emotions (selected by literature review, an expert-panel and the psychometric process) in 32 items. It includes the different emotions mentioned earlier: anger (with a strong focus on political attitude), anxiety (in a less clinical approach than the other scales,

more oriented towards apprehension or worry) sadness, guilt and powerlessness. They also include what they call enthusiasm to capture various positive climate emotions including hope or joy; we might criticize the fact that the distinction suggested by Ojala (constructive hope versus hope based on denial; 2012) is not really integrated into these items. Two emotions that are less widely discussed in the literature complete this list, i.e. contempt and isolation. Contempt investigates the feeling of “too much green”, the hostility toward the subject of climate, which distinguishes it from the others as the only “anti-green” emotion. Isolation describes the sense of loneliness felt by individuals who feel little considered by their relatives less committed to the environmental issue, which may echo the “consequences on social life” factor found in some climate anxiety scales (Jalin et al., 2025). By using the ICE in conjunction with the scales mentioned above, a broader spectrum of the emotional experience can be assessed : from “ normal” to “clinical”.

In our opinion, the added value of this scale also lies in the fact that the various items focus on the specific characteristics of each of the climate emotions, thus enabling a more refined approach than scales constructed with word-items and a simple statement orienting towards the environmental theme (e.g. Galway & Beery, 2022). From a psychometric standpoint, the scale was initially validated in Polish, then in English (Ireland and Australia), Norwegian, German and Chinese (Marczak et al., 2023, 2024; Metzen et al., 2025; Rice et al., 2025; Shao & Yu, 2025). It was subjected to analyses of its structural, convergent, discriminant and nomological validity, as well as its reliability and sensitivity. On the whole, these studies show good measurement quality ; with the exception of powerlessness that shows poorer indicators and the Chinese validation that exhibited more psychometric difficulties.

Several reasons justify a French version of the Inventory of Climate Emotions. Firstly, there is an interest in having a scale in French that complements those available that measure solely climate anxiety. Previous studies on the scale have also recommended further cross-cultural work and in this respect, it is relevant to examine whether the French context

(stemming from a Latin culture) may differ from the other contexts in which the scale has been validated (Poland, Ireland, Norway, Australia, Germany). Moreover, climate change is increasingly becoming a perceptive experience in France, as the first consequences of climate change (floods, droughts, fires) are increasingly being felt in mainland France (French High Committee for Climate, 2024); and it would seem highly appropriate to examine the effect of these environmental changes on individuals. Finally, a recent representative study on climate anxiety (Sutter et al., 2025) has revealed that this is a major phenomenon (extrapolated to 2.1 million highly eco-anxious individuals) in France, reinforcing the need for a robust assessment of all climate emotions.

### **1.3 An opportunity to explore climate emotions profile**

The existence of the ICE brings the opportunity to deploy a person-centered approach such as latent profile analysis (LPA). Indeed, this statistical approach can be used to identify specific profiles in terms of emotional experiences of environmental issues. Whereas the classic variable-centered approach (e.g., regressions, structural models) reveals relationships between constructs at a global level, the advantage of LPA is that it can identify and characterize specific patterns of climate emotion experiences. This exploration could be supplemented by examining the associations between the profiles and other relevant constructs, again with the aim of characterizing the profiles in relation to the relevant phenomena. Several studies already used LPA to examine environment-related variables. Authors mobilized this approach to study environmental attitudes, beliefs, awareness (Jürkenbeck et al., 2021; Kácha et al., 2022; Rhead et al., 2018) or coping strategies (Helm et al., 2022). Several studies also focus specifically on emotional aspects, with research on worry (Sciberras & Fernando, 2022), anxiety (Hogg et al., 2025; Veijonaho et al., 2024; Wullenkord et al., 2024) but also grief and guilt (Ágoston et al., 2024). One of the added values of such recent studies is that they characterized a profile of individuals whose emotional and behavioral investment in environmental issues leads to negative consequences.



These studies also examined associations with various covariates, including pro-environmental behaviors, mental health indicators (anxiety, depression, life satisfaction), efficacy beliefs, political orientation and demographic characteristics. Despite differences in operationalization and context (samples from different continents ; some involving only young people and others not), these studies generally identify links between belonging to a particular emotional profile and environmental action, mental health, or gender. In addition, comparable profiles are generally found in the different studies, i.e., a profile hostile to environmental issues, a majority group of fairly neutral individuals, and a group of individuals who are committed or even overly committed to environmental issues. This seems to highlight a certain linearity, since these profiles can be placed on a spectrum ranging from very disengaged to very engaged in environmental issues (emotionally, behaviorally, and attitudinally) rather than specific profiles that function differently. Incorporating a broader range of climate emotions into a person-centered approach could challenge the conclusions drawn from these studies (Ágoston et al., 2024; Hogg et al., 2025; Sciberras & Fernando, 2022; Veijonaho et al., 2024; Wullenkord et al., 2024). Still with the aim of supplementing or refuting the existing literature, we believe it is relevant to use the ICE, which relates more to the “normal” emotional experience of the environmental crisis, whereas previous studies have used more symptom-oriented tools.

## **1.4 Objectives of the study**

The first aim of this study is therefore to provide a French translation of the Inventory of Climate Emotions and to evaluate its psychometric properties as exhaustively as possible. We propose to evaluate sensitivity, reliability (internal consistency and test-retest) and different facets of validity (structural, convergent, discriminant, nomological).

Once the psychometric qualities of this scale have been established, we propose to explore the existence of climate emotion profiles by employing a person-centered approach, complementing this method by examining associations with other constructs.

## 2. METHODS

### 2.1 Procedure and sample

This survey is part of a wider study focusing on climate emotions, their determinants and their impact on behaviors. As part of this survey, a questionnaire (implemented through LimeSurvey) was disseminated online between December 2024 and February 2025. Participants (N=1650) were recruited through social networks (LinkedIn, Instagram, Facebook, Discord), through university mailing lists in several French universities as well as through word-of-mouth. For test-retest reliability and longitudinal invariance analysis, the data of the respondents who participated in the second phase of the study was also used (February to May 2025, N=708). This convenience sample is made up of 1,650 French respondents aged 18 to 30, with an average age of 22.45 (SD=3.42). The sample is predominantly female (N=966, 58.55%) and student (N=1166, 70.67%), residing in large urban centers (N=858, 52%). For the highest level of diploma obtained and the type of household, a relatively balanced distribution is observed.

**Table 1.** Sample characteristics

	N=1650	%
<b>Gender</b>		
Female	966	58.55%
Male	605	36.67%
Non-binary and others	79	4.79%
Missing	0	0%
<b>Age</b> (Mean=22.45, SD=3.42)		
18 - 21 years old	765	46.36%
22 - 25 years old	529	32.06%
26 - 30 years old	356	21.58%
Missing	0	0%
<b>Highest obtained diploma</b>		
Highschool's degree	647	39.21%
Bachelor's degree or equivalent	460	27.88%
Master's degree or equivalent or higher	543	32.91%
Missing	0	0%
<b>Occupation</b>		
Student	1166	70.67%
Employed	402	24.36%
Looking for a job or other	82	4.97%

	situations Missing	0	0%
<b>Place of residence</b>			
Rural area		214	12.97%
Small city (<20,000 inhabs.)		265	16.06%
Medium city (20,000 – 100,000 inhabs.)		311	18.85%
Large city (>100,000 inhabs.)		858	52%
Missing		2	0.12%
<b>Household type</b>			
Alone		580	35.15%
With their family		473	28.67%
With a partner		349	21.15%
Shared flat		245	14.85%
Missing		3	0.18%

## 2.2 Materials

**The Inventory of Climate Emotions** (Marczak et al., 2023) is a 32-item scale designed to assess 8 emotions related to environmental crisis (each emotion being measured by 4 items): anger, contempt, hope/enthusiasm, powerlessness, guilt, isolation, anxiety and sorrow. The scale does not provide a total score but subscores related to each emotion. Participants are asked to express their degree of agreement with the items on a scale from 1 (“strongly disagree”) to 5 (“strongly agree”). The available studies highlighted excellent structural validity indicators in CFA, satisfactory nomological validity and reliability indicators (internal consistency and test-retest) ranging from acceptable to satisfactory. Based on the recommendations of the COSMIN check-list (Mokkink et al., 2019), the ICE was translated and back-translated by two independent professional translators (one being also a psychologist, the other not). The scale was first translated from English into French by the first translator, then back into English by the second translator. This was followed by a process of harmonization between the two translators and the main author of the study to discuss translation choices, apply corrections and finalize the French translation. All the material used is available in French and English in Appendix A.

In order to assess the nomological validity of the ICE, additional relevant constructs were evaluated. It included:

- Clinical climate anxiety, measured with the Climate Anxiety Scale (13 items) (Clayton & Karazsia, 2020), in its French version validated by Mouguiama-Daouda et al. (2022) ;
- Environmental awareness with 3 items adapted from the Climate Change Perceptions Scale by Van Valkengoed et al. (2021) ;
- Connectedness to nature with the concentric circles single item of Schultz (2001) ;
- Political orientation, with an ad hoc item (0 “Far left” to 10 “Far right”).
- Daily pro-environmental behaviors (PEB) with an adaptation of the Proenvironmental Behavior Scale (13 items) of Markle (2013), also incorporating items from the scale of Brick et al. (2017).
- Political engagement behaviors with the Environmental Action Scale (18 items) by Alisat & Riemer (2015). This scale consists of two sub-scores: commitment behaviors and leadership behaviors. Leadership behavior was not used since it was found to be very skewed in the sample (skewness=2.77, kurtosis=10.8).

All these tools asked the participant to respond on a scale of 1 to 5, either in terms of frequency or degree of agreement. With the exception of the Climate Anxiety Scale, all the other scales were translated for this project using the method described above. Brief psychometric analyses (internal consistency fidelity and Confirmatory Factor Analysis) of the various scales are available in appendices B-1 to B-4. Within each of the scales used in the study, the items were presented in random order.

## **2.3 Analytic approach**

The psychometric study aimed to evaluate the three main properties of this French version: sensitivity, reliability and validity. Sensitivity was evaluated with various descriptive indicators (mean, standard deviation, range), normality indicators of skewness and kurtosis (using the -1 / -1 interval, Hair et al., 2019) and graphical analysis.

Reliability analysis focused firstly on the internal consistency of the scale, using Cronbach's alpha and McDonald's omega. Secondly, the temporal stability of the sub-scale scores was investigated, using test-

retest correlations between the scores and a second measurement 9 to 11 weeks later (mean interval 72.4 days,  $SD=5.77$ ). Both types of reliability are considered acceptable if they are greater than 0.70. (Evers et al., 2013; Nunnally, 1978).

Finally, the validity analysis is divided into several sections. First, regarding structural validity, a Confirmatory Factorial Analysis (CFA) was performed, with the standard fit evaluation criteria (Hu & Bentler, 1999). An invariance analysis was then carried out (Meredith, 1993), to ensure that the test structure is robust. Invariance guarantees that differences observed between groups or over time are due to differences in construct level rather than to methodological biases in the questionnaire. The analysis presents both an intergroup analysis (gender, education level, occupational status) and a longitudinal analysis, to check that the structure is the same between groups and is stable over time. In line with the literature (Putnick & Bornstein, 2016), three levels of invariance were successively tested: configural invariance, metric invariance, and scalar invariance. For technical details regarding the computation of these analysis and the fit evaluation, see Appendix C.

Next, convergent and discriminant validities were examined: in accordance with the literature (Lim, 2024), we rely respectively on the Average Variance Extracted of each latent factor (satisfactory above 0.70, acceptable above 0.50); and on the Heterotrait-Monotrait matrix of correlations between latent factors (satisfactory if no correlation above 0.85). Lastly, nomological validity is examined using a correlation matrix examining associations between ICE sub-scores and the psychological constructs mentioned above (summary of expected results and associated rationales in Appendix D).

The Latent Profile Analysis (LPA) was performed using the eight emotion scores from the ICE. This method provides a probabilistic way of modeling a latent categorical variable (i.e. belonging to a profile) from a set of continuous manifest variables (Oberski, 2016). The choice of the number of profiles was based on several criteria detailed in Appendix E. In addition, two multinomial logistic regressions were performed to explore the

variables associated with the profiles. The first focused on psychological constructs, with the same variables mentioned earlier for nomological validity. The second examined links with socio-demographic characteristics: gender, age, occupation, education, place of residence, media exposure to environmental information (ad hoc item, 0 “Never” to 10 “Everyday”).

All analyses were performed on R v.4.4.1, using several packages including *lavaan v0.6* (Rosseel et al., 2023) , *psych v2.4.6* (Revelle, 2023), *semTools v0.5*. (Jorgensen et al., 2022) and *tidyLPA v1.1.0* (Rosenberg et al., 2019).

## 3. RESULTS

### 3.1 Psychometric study

#### 3.1.1 Descriptive and sensitivity analysis

The descriptive analysis revealed relatively high levels of several negative climate emotions: anger, sorrow, anxiety. Hope/enthusiasm and guilt show average levels, while contempt and isolation have fairly low averages. With regard to sensitivity, normality indicators and graphical analyses (Appendix F) revealed a sensitivity issue for anger, which showed a very clear ceiling effect and indicators well above normality thresholds (skewness=-1.82, kurtosis=3.52). To a lesser extent, the same was true for sorrow, whose indicators were very slightly below the threshold (skewness=-0.995, kurtosis=0.979).

**Table 2.** Descriptive statistics and normality indicators

	Mean	Standard deviation	1st quartile	3rd quartile	Skewness	Kurtosis
Anger	4.427	0.790	4.000	5.000	-1.820	3.528
Anxiety	3.729	0.861	3.250	4.250	-0.734	0.289
Sorrow	3.995	0.821	3.500	4.750	-0.995	0.979
Isolation	2.462	0.928	1.750	3.000	0.429	-0.410
Guilt	3.100	0.992	2.250	4.000	-0.280	-0.633
Powerlessness	3.395	0.802	3.000	4.000	-0.437	-0.112
Hope/enthusiasm	3.071	0.815	2.500	3.750	-0.163	-0.379
Contempt	2.079	0.849	1.500	2.500	0.802	0.373

### 3.1.2 Reliability analysis

The results of the reliability analysis are shown in Table 3. Drawing on Cronbach's  $\alpha$  and McDonald's  $\omega$ , internal consistency reliability was found to range from acceptable to satisfactory. Two dimensions showed poorer indicators, namely powerlessness ( $\alpha=.650$ ,  $\omega=.695$ ), which was below acceptance thresholds, and hope/enthusiasm, which is slightly above ( $\alpha=.706$ ,  $\omega=.743$ ). A similar finding was made on Test-retest reliability, i.e. globally acceptable indicators for the different emotions with the exception of powerlessness (.660 [.616, .699]) and hope/enthusiasm (.693 [.653, .730]).

**Table 3.** Internal consistency and test-retest reliability indicators.

	Cronbach's $\alpha$	McDonald's $\omega^1$	Test-retest correlat ion <sup>2</sup>	Test-retest p- value
Anger	.878	.934	.809 [.782, .833]	<.001
Anxiety	.782	.838	.750 [.716, .781]	<.001
Sorrow	.785	.844	.759 [.726, .789]	<.001
Isolation	.788	.825	.744 [.709, .775]	<.001
Guilt	.863	.895	.783 [.752, .81]	<.001
Powerlessness	.650	.695	.660 [.616, .699]	<.001
Hope/ enthusiasm	.706	.743	.693 [.653, .73]	<.001
Contempt	.736	.817	.731 [.695, .764]	<.001

Notes : <sup>1</sup> MacDonal'd's  $\omega$  were estimated from the factor structure shown below. <sup>2</sup> These are Bravais-Pearson correlations.

### 3.1.3 Validity analysis

#### **Structural validity**

The Confirmatory Factor Analysis tested on the 8-factor ICE structure showed a satisfactory fit for all indicators considered:  $\chi^2(436)=2669.207$ , CFI=.945, TLI=.938, RMSEA=.056, SRMR=.051. Moreover, as shown in table 4., 30 of the 32 items have a factor loading greater than .50, the only exceptions (even using CI95%) being HOPE2 ( $\beta=.402$ ) and POWERLESSNESS3( $\beta=.450$ ). This is a further indicator of good fit. Examination of the correlations between the latent factors (Appendix G) also enabled us to note that some emotions are very closely linked to each other (sorrow, anxiety and anger form a "trio"), while others (e.g. hope), are relatively independent. As already mentioned, invariance analysis was

also an important step to ensure that the structural validity of the scale is maintained under different conditions: with different groups and over time. According to the reference thresholds, the ICE was found (see Appendix H for complete results) to be invariant to the three characteristics considered (gender, employment status, highest obtained diploma) and also invariant over time.

**Table 4.** Factor loadings of the ICE in the 8-factors CFA

Dimension	Item	$\beta$ [CI95%]	p-value
<b>Colère (Anger)</b>	1. Je me sens en colère que le système politique et économique dans lequel nous vivons nuit au climat. <i>(I feel angry that the political and economic system that we live in harms the climate.)</i>	.923 [.906,.939]	<.001
	2. Je suis indigné.e que les politicien.nes aient permis au changement climatique d'aller si loin. <i>(I am outraged that politicians allowed climate change to come this far.)</i>	.844 [.821,.868]	<.001
	3. Je me sens indigné.e par les entreprises qui nuisent au climat. <i>(I feel outraged at corporations that harm the climate.)</i>	.857 [.834,.880]	<.001
	4. Je ressens de la colère lorsque je pense aux représentant.e-s politiques qui retardent les efforts pour atténuer le changement climatique. <i>(I feel anger when I think of politicians who delay efforts to mitigate climate change.)</i>	.910 [.892,.928]	<.001
<b>Anxiété (Anxiety)</b>	1. Penser au changement climatique me fait craindre pour l'avenir de nos enfants. <i>(Thinking about climate change makes me fear for the future of our children.)</i>	.755 [.726,.785]	<.001
	2. Je suis submergé.e par l'imminence de la catastrophe climatique. <i>(I am overwhelmed by the awareness of the approaching climate disaster.)</i>	.814 [.790,.839]	<.001
	3. Tout semble incertain à cause du changement climatique. <i>(Everything seems uncertain because of climate change.)</i>	.667 [.633,.702]	<.001
	4. J'ai peur de la manière dont le changement climatique m'affectera moi et mes proches <i>(I fear how climate change will affect me and my loved ones.)</i>	.716 [.687,.745]	<.001
<b>Chagrin (Sorrow)</b>	1. La pensée que tant d'espèces s'éteignent sous la pression du changement climatique me remplit de chagrin. <i>(The thought of so many species going extinct under the pressure of climate change fills me with sorrow.)</i>	.753 [.725,.781]	<.001
	2. La pensée que le monde que je connais est en train de disparaître pour toujours à cause du changement climatique me rend triste. <i>(The thought that the world I know is disappearing forever because of climate change makes me sad.)</i>	.740 [.709,.770]	<.001
	3. Je me sens attristé.e que nous perdions à jamais des possibilités à cause du changement climatique. <i>(I feel sorry about the possibilities we are losing forever because of climate change.)</i>	.703 [.668,.738]	<.001
	4. Je suis triste que tant d'êtres vivants souffrent à cause du changement climatique. <i>(I am sad that so many living creatures suffer because of climate change.)</i>	.840 [.814,.866]	<.001
<b>Isolement (Isolation)</b>	1. Je me sens être une des seules personnes qui comprend réellement ce qu'implique le changement climatique. <i>(I feel like one of the few people who actually understand what climate change entails.)</i>	.589 [.545,.633]	<.001
	2. Je me sens seul.e car la plupart des gens autour de moi ne se préoccupent pas autant que moi du changement climatique. <i>(I feel lonely because most of the people around me don't care about climate change as much as I do.)</i>	.746 [.712,.780]	<.001
	3. Je me sens seul.e car c'est difficile de parler de mes inquiétudes concernant le changement climatique avec d'autres personnes. <i>(I feel lonely because it's difficult to talk about my climate change concerns with other</i>	.781 [.748,.814]	<.001



	people.) 4. Je me sens à part puisque la société considère l'inquiétude liée au changement climatique comme quelque chose d'étrange. <i>(I feel alienated because society considers concern for climate change as something strange.)</i>	.817 [.781,.853]	<.001
<b>Culpabilité (Guilt)</b>	1. J'ai mauvaise conscience de ne pas faire suffisamment pour atténuer le changement climatique. <i>(I have a guilty conscience about not doing enough to mitigate climate change.)</i>	.840 [.819,.860]	<.001
	2. Je suis contrarié·e d'avoir un gros impact négatif sur le climat. <i>(It upsets me that I have a big negative impact on the climate.)</i>	.780 [.755,.805]	<.001
	3. Je me sens coupable que mon mode de vie contribue au changement climatique. <i>(I feel guilty that my lifestyle contributes to climate change.)</i>	.858 [.839,.877]	<.001
	4. Je suis en colère contre moi-même de ne pas faire assez pour limiter mon impact négatif sur le climat. <i>(I am angry at myself for not doing enough to limit my negative impact on the climate.)</i>	.821 [.800,.842]	<.001
<b>Impuissanc e (Powerless ness)</b>	1. Je me sens confus.e concernant ce que je peux faire pour réduire le changement climatique. <i>(I feel confused about what I can do to reduce climate change.)</i>	.584 [.535,.633]	<.001
	2. Je me sens dépassé.e par le nombre d'aspects de la vie qui devraient être changés pour limiter le changement climatique. <i>(I am overwhelmed by how many aspects of life would need to be changed to limit climate change.)</i>	.629 [.585,.674]	<.001
	3. En tant qu'individu, je me sens impuissant.e sur ce qui se passe vis-à-vis du climat. <i>(As an individual, I feel powerless with little agency over what happens with the climate.)</i>	.450 [.397,.503]	<.001
	4. Je me sens impuissant.e quand je pense à quel point il est difficile de vivre en respectant le climat. <i>(I feel helpless when I think of how difficult it is to live in a climate-friendly way.)</i>	.735 [.695,.776]	<.001
<b>Espoir / Enthousias me (Hope/ Enthusiasm )</b>	1. L'engagement croissant du public envers le changement climatique me donne de l'espoir. <i>(The increasing public engagement with climate change gives me hope.)</i>	.678 [.638,.717]	<.001
	2. Je crois qu'il y a des solutions émergentes qui nous permettront d'arrêter le changement climatique. <i>(I believe that there are emerging solutions that will allow us to stop climate change.)</i>	.409 [.361,.458]	<.001
	3. Les actions concrètes pour le climat me permettent d'être optimiste par rapport au futur. <i>(Concrete actions for the climate allow me to be optimistic about the future.)</i>	.582 [.541,.624]	<.001
	4. La mobilisation sociale concernant le combat contre le changement climatique me fait ressentir qu'ensemble nous pouvons atteindre cet objectif. <i>(Social mobilisation in the fight against climate change makes me feel that together we can achieve this goal.)</i>	.886 [.843,.928]	<.001
<b>Dédain (Contempt)</b>	1. Cela m'agace de voir les gens succomber à l'hystérie climatique. <i>(It annoys me to watch people succumb to climate hysteria.)</i>	.923 [.906,.939]	<.001
	2. Je suis agacé.e par la communication constante autour du changement climatique. <i>(I am annoyed by the constant publicity around climate change.)</i>	.844 [.821,.868]	<.001
	3. J'en ai assez d'entendre parler du changement climatique. <i>(I am bored of hearing about climate change.)</i>	.857 [.834,.880]	<.001
	4. Je suis surpris.e que des gens font l'expérience d'émotions fortes en lien avec le changement climatique. <i>(I am surprised that people experience strong emotions in connection with climate change.)</i>	.910 [.892,.928]	<.001

### ***Convergent, discriminant and nomological validity***

Table 5 shows information on the convergent and discriminant validity of the ICE. Regarding convergent validity, most emotions show an AVE above the .50 threshold, with the exception of Hope/enthusiasm (AVE=.437) and powerlessness (AVE=.370), already identified as

underperforming in previous sections. With regard to discriminant validity, the Heterotrait-Monotrait correlation matrix reveals that none of the 28 latent inter-factor correlations is problematic (i.e.  $>.85$ ) - although the anxiety/sorrow association is close to the threshold ( $r=.838$ ).

**Table 5.** Convergent and discriminant validity: Average Variance Extracted (AVE) and Heterotrait-Monotrait correlation matrix of ICE latent factors in 8-factor AFC.

	Anger	Anxiety	Sorrow	Isolation	Guilt	Powerlessness	Hope/enthusiasm	Contempt
Anger	<b>.781</b> [.755,.807]							
Anxiety	.761 [.723,.796]	<b>.548</b> [.518,.577]						
Sorrow	.760 [.721,.797]	.838 [.801,.873]	<b>.578</b> [.548,.607]					
Isolation	.451 [.390,.506]	.561 [.502,.611]	.442 [.376,.495]	<b>.545</b> [.517,.575]				
Guilt	.488 [.436,.536]	.565 [.512,.615]	.580 [.532,.625]	.396 [.323,.456]	<b>.680</b> [.658,.703]			
Powerlessness	.192 [.091,.262]	.452 [.382,.518]	.289 [.182,.365]	.157 [.097,.240]	.441 [.292,.529]	<b>.370</b> [.341,.402]		
Hope/enthusiasm	.111 [.063,.158]	.094 [.062,.134]	.118 [.064,.192]	.077 [.048,.121]	.085 [.056,.176]	.142 [.089,.235]	<b>.437</b> [.409,.464]	
Contempt	.712 [.658,.756]	.534 [.470,.589]	.552 [.489,.610]	.216 [.115,.284]	.358 [.291,.421]	.096 [.046,.168]	.124 [.080,.171]	<b>.529</b> [.497,.565]

*Notes : AVEs are shown on the diagonal, in bold, instead of auto-correlations which are all equal to 1. The confidence intervals are obtained through bootstrapping (N=1000 bootstrapped samples)*

Finally, regarding nomological validity, we investigated the correlations between the different climate emotion scores and a series of relevant psychosocial variables. The results are reported in Table 6, while the expected associations are summarized in Appendix D. For Anger, Contempt, Anxiety and Sorrow, the expected associations were overall identified, although some of them were weak ( $r<.30$ ). Nevertheless, the results highlighted a fragile nomological validity for Hope/enthusiasm, whose correlations with behavior scores were significant but weak; the

same was true for powerlessness. Guilt also showed partially satisfactory indicators, most of which were in line with expectations.

**Table 6.** Nomological validity: Bravais-Pearson correlation matrix between ICE scores and associated psychological constructs.

		Anger	Anxiety	Sorrow	Isolation	Guilt	Powerlessness	Hope/enthusiasm	Contempt
Clinical climate anxiety	r	.369 [.326, .410]	.523 [.487, .558]	.409 [.368, .448]	.526 [.491, .560]	.409 [.368, .449]	.183 [.136, .229]	.021 [-.027, .069]	-.256 [-.300, -.210]
	p	<.001	<.001	<.001	<.001	<.001	<.001	.388	<.001
Environmental awareness	r	.567 [.533, .599]	.471 [.433, .508]	.448 [.409, .486]	.174 [.127, .220]	.309 [.265, .352]	.114 [.066, .162]	.107 [.059, .154]	-.515 [-.550, -.479]
	p	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Connectedness to nature	r	.154 [.107, .201]	.167 [.12, .214]	.254 [.208, .298]	.188 [.141, .234]	.097 [.049, .145]	-.103 [-.151, -.055]	.109 [.062, .157]	-.168 [-.214, -.12]
	p	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Political orientation	r	-.583 [-.614, -.551]	-.385 [-.425, -.343]	-.340 [-.382, -.297]	-.196 [-.242, -.150]	-.249 [-.294, -.204]	-.012 [-.060, .036]	.039 [-.010, .087]	.557 [.522, .589]
	p	<.001	<.001	<.001	<.001	<.001	.626	.117	<.001
Daily PEBs	r	.356 [.313, .397]	.300 [.256, .344]	.291 [.246, .334]	.230 [.184, .275]	.114 [.066, .161]	-.133 [-.180, -.085]	.067 [.019, .115]	-.328 [-.37, -.284]
	p	<.001	<.001	<.001	<.001	<.001	<.001	.006	<.001
Environmental commitment	r	.303 [.258, .346]	.305 [.261, .348]	.277 [.231, .321]	.296 [.251, .339]	.129 [.081, .176]	-.159 [-.205, -.111]	.125 [.077, .172]	-.307 [-.35, -.263]
	p	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001

### 3.2 Exploring the climate emotions profiles : Latent profile analysis and multinomial logistic regression

As mentioned, this study also investigated the existence of potential profiles of climate emotions experiences. After performing the Latent Profile Analysis, the several indicators led us to select the four-profile solution. The rationale supporting this decision is available in Appendix E. Examination of the Z-scores (Table 7, Graph 1) and unstandardized scores (Appendix I) allowed us to make an initial interpretation of the psychological reality behind the profiles. This was refined by consulting the multinomial logistic regression model (Table 8), which presents associations with various psychological variables.

**Table 7.** Z-scores means of climate emotions according to the profiles

<b>Emotion</b>	<b>Normative aware (N=1279, 77.5%)</b>	<b>Climate angry (N=101, 6.1%)</b>	<b>Climate hostile (N=138, 8.4%)</b>	<b>Climate affected and active (N=132, 8.0%)</b>
	Mean [CI95%]	Mean [CI95%]	Mean [CI95%]	Mean [CI95%]
Anger	0.213 [0.160;0.267]	0.020 [-0.171;0.212]	-2.454 [-2.787;- 2.121]	0.478 [0.406;0.550]
Anxiety	0.160 [0.087;0.232]	-1.028 [-1.439;- 0.618]	-1.200 [-1.508;- 0.892]	0.547 [0.318;0.776]
Sorrow	0.234 [0.171;0.297]	-1.716 [-2.003;- 1.428]	-1.272 [-1.613;- 0.930]	0.547 [0.395;0.699]
Isolation	-0.072 [-0.223;0.079]	-0.484 [-0.735;- 0.233]	-0.612 [-0.789;- 0.434]	1.342 [0.728;1.957]
Guilt	0.229 [0.101;0.356]	-0.811 [-1.061;- 0.560]	-1.017 [-1.246;- 0.788]	-0.242 [-0.858;0.373]
Powerlessness	0.157 [0.089;0.225]	-0.494 [-0.901;- 0.086]	-0.455 [-0.673;- 0.237]	-0.408 [-0.780;-0.035]
Hope/Enthusiasm	0.122 [0.056;0.188]	-0.244 [-0.566;0.079]	-0.279 [-0.471;- 0.086]	-0.475 [-0.796;-0.155]
Contempt	-0.102 [-0.161;- 0.042]	0.243 [-0.222;0.708]	1.350 [1.081;1.619]	-0.549 [-0.738;-0.360]

**Notes :** *These estimates are directly extracted from the LPA, and therefore the estimates of each profile are weighted by the attribution probabilities of the individuals associated to this profile.*

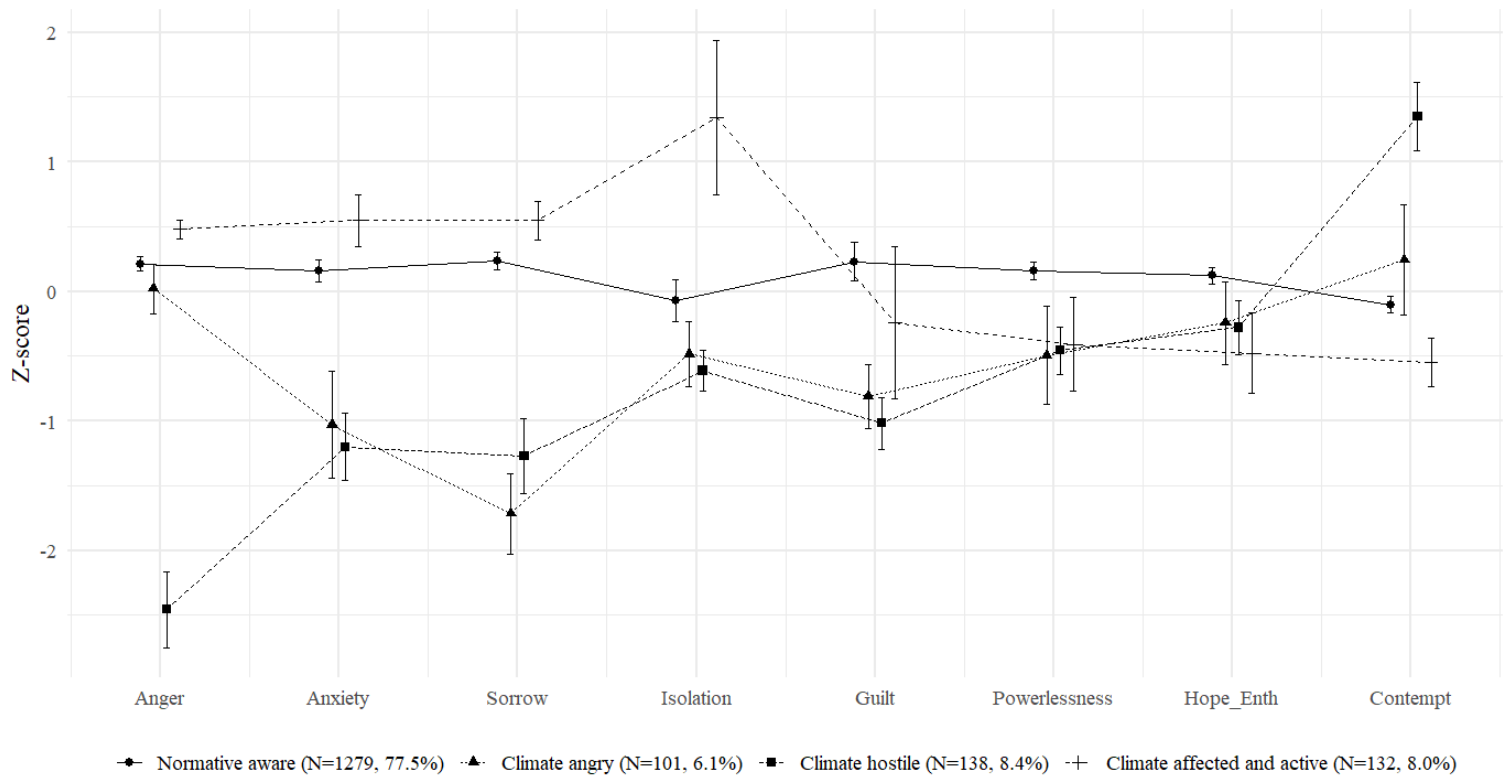
Profile 1 (N=1279, 77.5%) is the typical participant in the sample, with mean Z scores close to zero. These respondents had high mean scores of anger, sadness, and anxiety, very low contempt and low isolation, and relatively moderate emotions of hope, powerlessness, and guilt. These respondents were labelled as “normative-aware” – they are conscious of the environmental issues but not emotionally impaired, which is quite the norm of this sample. Profile 2 (N=101, 6.1%) were named “climate angry.” They showed anger and contempt scores relatively close to the overall sample average (hence, high level of anger and low level of contempt), but all other emotions were well below average, particularly anxiety and sadness, whose Z scores (Sadness=-1.72, Anxiety=-1.03) are particularly low. This interpretation is confirmed by the regression, which highlights a clinical climate anxiety that is significantly lower (OR=0.32 [0.22 – 0.48]) compared to the reference group (profile 1). No difference is found regarding behavior or political orientation, but these individuals tend to be less aware of climate change (OR=0.65 [0.53 – 0.82]) and less connected to

nature (OR=0.69 [0.54 - 0.87]). Profile 3 (N=138, 8.4%) referred to the “climate hostile”. It showed a very high score for Contempt (Z=1.35) and, conversely, a score for anger well below the sample average (Z=-2.45). The regression confirmed this idea of a profile that is hostile to environmental issues, with a political orientation that is much further to the right than the reference sample (OR=2.77 [2.18 - 3.51]), less clinical climate anxiety (OR=0.60 [0.42 - 0.87]) and less environmental awareness (OR=0.48 [0.40 - 0.58]). It was not found to be significant in the regression model, but this profile also had the lowest Z-scores of daily green behaviors (Z=-0.75) and environmental commitment (Z=-0.59). Finally, Profile 4 (N=132, 8.0%) showed higher than average levels of anger (Z=0.48), sadness (Z=0.55), and anxiety (Z=0.55), but above all, a feeling of isolation (Z=1.34) that was well above the sample average. These participants therefore felt particularly unsupported and misunderstood by their loved ones with regard to their environmental concerns. However, this climate emotional profile is not homogeneous, as these participants also showed lower results for powerlessness (Z=-0.41) and hope (Z=-0.47). Here too, the logistic model provided insights, revealing that these respondents were more aware (OR=1.91 [1.10 - 3.30]), more burdened (OR=1.38 [1.15 - 1.65]) and more connected to nature (OR=1.34 [1.10 - 1.63]). These respondents also showed the highest Z-scores of daily ecological behaviors (Z=0.51) and environmental commitment (Z=0.57), although it was not statistically significant compared to reference group. These individuals were therefore described as “climate affected but climate active.”

Finally, consultation of the second multinomial logistic regression (Appendix K) provided us supplementary information on the profiles. The most notable result was the significant gender difference, as there was a significant overrepresentation of men in the climate angry (OR=2.21 [1.44 - 3.38]) and climate affected (OR=2.48 [1.68 - 3.66]) profiles, and even more so in the climate hostile group (OR=4.97 [3.33 - 7.48]) compared to the reference group. Media exposure to environmental information was also lower in the angry and hostile profiles compared to the reference group. Some more marginal results were also observed, such as an

underrepresentation of hostile individuals in large cities (OR=0.54 [0.31 – 0.94]) and an increased probability of belonging to the affected profile while getting older (OR=1.11 [1.02 – 1.21]).

**Graph 1.** Z-score means of climate emotions according to the profiles



**Table 8.** Multinomial logistic regression associating profiles and relevant psychological variables

Predictors	Mean Z score: profile vs reference	OR [CI95%]	p
<b>Profile 2 ("Climate Angry") versus Reference profile ("Normative aware")</b>			
Clinical Climate Anxiety	-0.62 vs 0.05	0.32 [0.22 – 0.48]	<b>&lt;.001</b>
Environmental awareness	-0.21 vs 0.15	0.65 [0.53 – 0.82]	<b>&lt;.001</b>
Connectedness to nature	-0.44 vs 0.02	0.69 [0.54 – 0.87]	<b>.002</b>
Political Orientation	-0.02 vs -0.11	0.81 [0.63 – 1.05]	.110
Daily Pro-Environmental Behaviors	-0.22 vs 0.05	0.98 [0.76 – 1.26]	.874
Environmental Commitment	-0.26 vs 0.03	1.16 [0.89 – 1.52]	.262
<b>Profile 3 ("Climate Hostile") versus Reference profile ("Normative aware")</b>			
Clinical Climate Anxiety	-0.65 vs 0.05	0.60	<b>.00</b>

		[0.42 - 0.87]	<b>7</b>
Environmental awareness	-1.58 vs 0.15	0.48 [0.40 - 0.58]	<b>&lt;.01</b>
Connectedness to nature	-0.37 vs 0.02	0.83 [0.65 - 1.07]	.146
Political Orientation	1.45 vs -0.11	2.77 [2.18 - 3.51]	<b>&lt;.01</b>
Daily Pro-Environmental Behaviors	-0.75 vs 0.05	0.83 [0.63 - 1.11]	.212
Environmental Commitment	-0.59 vs 0.03	1.10 [0.80 - 1.52]	.548

**Profile 4 (“Climate affected and active”) versus Reference profile (“Normative aware”)**

		1.38	<b>&lt;.01</b>
Clinical Climate Anxiety	0.68 vs 0.05	[1.15 - 1.65]	<b>.01</b>
Environmental awareness	0.35 vs 0.15	1.91 [1.10 - 3.30]	<b>.02</b>
Connectedness to nature	0.49 vs 0.02	1.34 [1.10 - 1.63]	<b>.00</b>
Political Orientation	-0.41 vs -0.11	0.90 [0.69 - 1.15]	.395
Daily Pro-Environmental Behaviors	0.51 vs 0.05	1.20 [0.97 - 1.50]	.094
Environmental Commitment	0.57 vs 0.03	1.16 [0.95 - 1.40]	.144

*Notes : All predictors were standardized prior to analysis (M = 0, SD = 1), so Odds Ratios represent the effect of a one standard deviation increase.*

## 4. DISCUSSION AND CONCLUSION

Recent work in environmental psychology has consistently emphasized the central role of affects and emotions in the reaction to environmental crisis, both in terms of its potentially deleterious consequences for mental health and well-being (Bourque & Cunsolo Willox, 2014; Clayton, 2020; Coffey et al., 2021; Pihkala, 2022) and the propensity of emotions to be resources for pro-environmental action (Ágoston et al., 2024; Ágoston, Urbán, et al., 2022; Ogunbode et al., 2022; Sampaio et al., 2023; Stanley et al., 2021). Therefore, it seems necessary to develop robust tools in order to provide a quality measurement of climate emotions in different linguistic contexts, including French. The aim of this study was therefore to propose a translation of the Inventory of Climate Emotions and to study its sensitivity, reliability and validity. Using Latent Profile Analysis, the next step was to explore the existence of possible emotional experience profiles based on this scale.

## **Discussing the psychometric qualities of the Inventory of Climate Emotions**

The translation and psychometric evaluation of this French version of the ICE has produced results that we consider satisfactory overall. We shall first present the scale's general qualities, before looking in more detail at the two sub-scores that generated difficulties: powerlessness and hope/enthusiasm. Firstly, sensitivity was considered acceptable, although not entirely satisfactory (1 score outside the thresholds). It is assumed, however, that this is an effect of the sample and recruitment method (convenience) rather than the scale itself. Previous papers using the ICE (Marczak et al., 2023, 2024; Metzen et al., 2025; Rice et al., 2025) showed less problematic results than those reported here, which supports our assumption of a sampling effect. Reliability was also generally adequate, with indicators ranging from acceptable to satisfactory for both internal consistency and temporal stability. This is in line with previous work, although the overall results were a little weaker. Structural validity, meanwhile, showed good results, with a structure that is well suited to the data and invariant to socio-demographic characteristics or over time. Our results on gender and time invariance confirmed earlier works (Marczak et al., 2024; Shao & Yu, 2025) and the others are new: this study is the first to highlight invariance according to socio-professional category and level of education. The reported structural validity was also better than the Australian and Chinese validations (Rice et al., 2025; Shao & Yu, 2025), perhaps due to the greater cultural proximity between the various European countries compared to Australia and China. Overall satisfactory results were also obtained for convergent and discriminant validity. As for nomological validity, the correlations observed were broadly in line with those expected. The various PEB scores were significantly correlated in the expected direction (positive for anger, guilt, anxiety and sorrow; negative for contempt and powerlessness). As expected, positive correlations were also observed between environmental awareness and anger, anxiety and sorrow, and between clinical climate anxiety and these same emotions. Finally, we also found some correlations that were not expected



(connectedness to nature and hope/enthusiasm and powerlessness, CPEs and feelings of isolation) but which we believe are theoretically plausible.

In this study, two dimensions were consistently inferior: hope and powerlessness. These emotions showed good sensitivity, but the measures of reliability were not as good, either below threshold or slightly above. The CFA confirmed these weaknesses, since it is on these two factors that factor loadings below .50 were found (*HOPE2* and *POWERLESSNESS3*). Similarly, it's the two emotions that showed convergent validity below the thresholds ( $AVE < 0.50$ ) and more fragile nomological validity: the expected correlations were significant, but none exceeded  $r = .20$ . These different observations lead us to emphasize that the scale, while globally satisfactory, probably measures these two emotions less well. These results are in line with studies carried out on the other versions of the scale concerning powerlessness, which had already been identified as performing worse. On the other hand, the psychometric weaknesses identified in the hope/enthusiasm subscale are relatively new, as previous studies have not revealed any weaknesses in terms of reliability or validity. There are several possible explanations for this, the first of which may be that translation work on these items was less effective. Also, this sample was made up of young adults – and we could assume that this generation may have a particular vision of climate hope, which is poorly measured by these items. We might also suppose that it's not a question of age but of nationality - perhaps the French have a different relationship to climate hope. Intergenerational or international invariance analyses would shed light on this point. Lastly, we can speculate that 4 items may not be enough to effectively measure hope. As described by Ojala (2012) who described “constructive hope” and “hope rooted in denial”, it is a complex and multifaceted construct; this duality of climate hope may have not been integrated enough into the development of this scale.

### **Discussing the profiles of climate emotions experiences**

The first notable finding from the profile analysis is that the “Normative aware” profile accounts for 77% of individuals, while the three more specific profiles represent 6 to 8% of respondents; this distribution

being almost reminiscent of a Gaussian distribution. The majority group in our sample is therefore still fairly aware of the issues at stake, and in this respect our results are similar to those of certain previous studies (Ágoston et al., 2024; Helm et al., 2022; Sciberras & Fernando, 2022; Wullenkord et al., 2024); while others (Hogg et al., 2025; Kácha et al., 2022; Rhead et al., 2018; Veijonaho et al., 2024) reveal a majority rather described as “normative carefree”. Sampling strategies and characteristics of different samples could provide a possible explanation for these differences.

Secondly, our results permitted to identify a profile of a “climate-affected and active” group, which we believe represents a more radical and intense version of class 1. These 132 individuals had more intense negative emotions and were the most aware and active, which could explain their lower sense of powerlessness. Conversely, they also had less hope—we could assume that this is a form of resignation linked to the (little) perceived impact of their actions. However, this strong emotional and behavioral commitment is not without consequences, as these participants also reported a strong sense of isolation and more mental health issues. This result is very consistent with other studies (Ágoston et al., 2024; Hogg et al., 2025; Veijonaho et al., 2024; Wullenkord et al., 2024) on climate anxiety, which also highlighted a small group (4 to 10% depending on the study) of individuals who reach a plateau in terms of anxiety, behavior, and impact on their mental health. These participants also showed greater connectedness to nature, as previously revealed by Wullenkord et al. (2024). And as Hogg et al. (2025) and Agoston et al. (2024) pointed out before, the fact that the most anxious individuals are also the most active reinforces the evidence that undermines the idea of eco-paralysis. Nevertheless, our study distinguishes itself by including other emotions such as powerlessness and hope, which enabled us to refine our understanding of this profile, as it highlighted a profile that is not monolithic, since not all “green” emotions were very high.

At the opposite end of the spectrum are climate hostiles, who are also relatively fewer in number (8.4%) in our sample compared to previous work (Kácha et al., 2022; Rhead et al., 2018), even among young people

(Jürkenbeck et al., 2021). These individuals feel few emotions other than contempt toward environmental issues, and they are the only group that is on average politically right-wing in the sample ; which ties in with the observations of Kácha et al. (2022). One of our key findings compared to previous studies (none of which included measures of anger) is probably the identification of the angry climate group (N=101, 6.1%). The existence of this group seems interesting to us because these individuals could perhaps be likened to climate hostile people. They have fairly similar characteristics: fewer climate emotions other than anger (or contempt), weaker environmental awareness, weaker connectedness to nature, and clinical climate anxiety greatly below average. We could then assume that while climate angry people invest their tension through pro-environmental anger, climate hostile people are more likely to feel aversion towards environmental issues; values and ideology being perhaps what tips the balance one way or the other. Finally, we also highlighted that men were overrepresented in the three “atypical” profiles—that is, among the hostile and the angry. This is in line with the previous work (Helm et al., 2022; Jürkenbeck et al., 2021; Kácha et al., 2022) which showed that less engaged profiles tend to be male. Nevertheless, men are also overrepresented among the minority profile of the most affected individuals, a finding that Wullenkord et al. (2024) were the only ones to have noted until now.

### **Strengths, limitations and conclusions of the study**

Regarding psychometric validation, this study represents the first translation of the ICE into French. It is also the largest psychometric study of this scale to date, previous studies having smaller samples (N=300 to 900). Our study also provided new information as the invariance to the socio-economic characteristics or the nomological validity with connectedness to nature. With regard to profile exploration, our results have supplemented many findings already known in a new cultural context (France), but also brought new information to light. Indeed, integrating a larger number of emotions in the modeling of profiles (notably anger, powerlessness, and hope) and little-studied covariates such as

connectedness to nature or political orientation helped to strengthen the understanding of climate emotion profiles.

However, these strengths must be considered in the light of the work's limitations. The biggest limitation lies in the sample, which was not representative. The procedure (voluntary participation, dissemination via social networks) resulted in an over-representation of people who are already climate-aware and probably more likely to feel climate emotions. The fact that this sample was made up solely of adults aged 18 to 30 represents another limitation. As such, this French version is therefore considered to be validated only with this specific population and the profiles identified cannot be generalized to a wider population. Finally, the psychometric analyses revealed weaknesses in the hope/enthusiasm scale that were absent from the other versions, which may call into question the quality of the translation work carried out on these items. This also requires us to exercise greater caution when interpreting the profiles, particularly for the three “atypical” profiles, where we noticed that this score was lower than that of the reference group. These various elements point to the need for future work to enable wider use of this French version: a more diversified and representative sample, a more systematic method of recruiting participants, possible refinement of the translation of certain items. It would also be interesting to test this translation in French-speaking contexts other than metropolitan France like overseas territories (e.g. Martinique, New Caledonia), French-speaking African countries or Quebec. Looking at the different profiles identified, it would be relevant to assess whether these profiles remain stable or evolve over time, by examining variations over several years, as Sciberras & Fernando (2022) or Veijonaho et al. (2024) have performed.

In any case, this study represents a contribution to the study of climate emotions. Firstly, because the profile analysis carried out revealed a little more about the different ways in which climate change is experienced, particularly with regard to minority profiles and their specific characteristics. This is also a significant contribution in the French-speaking world. In a context where researchers and practitioners have

until now mainly used climate anxiety scales with a symptom-approach, ICE provides a welcome complement. For the time being, this scale is one of the only ones that can assess the main climate emotions in a reasonable number of items. On the other hand, we can regret the absence of certain positive emotions that are the subject of considerable interest in the literature, notably pride or satisfaction in taking action (Brosch, 2021; Landmann, 2020). Nevertheless, the availability of this scale in French paves the way for more research exploring climate emotions, their determinants and their impact on behaviors, as we did with the person-centered approach in the second part of the study. In a more applied perspective, this tool can also be mobilized in various intervention contexts, whether to encourage proenvironmental action or preserve their mental health (Clayton et al., 2017; Doherty & Clayton, 2011; Reser et al., 2011) via various prevention or awareness-raising programs.

## 5. REFERENCES

- Ágoston, C., Balázs, B., Mónus, F., & Varga, A. (2024). Age differences and profiles in pro-environmental behavior and eco-emotions. *International Journal of Behavioral Development*, 48(2), 132-144. <https://doi.org/10.1177/01650254231222436>
- Ágoston, C., Csaba, B., Nagy, B., Kőváry, Z., Düll, A., Rácz, J., & Demetrovics, Z. (2022). Identifying Types of Eco-Anxiety, Eco-Guilt, Eco-Grief, and Eco-Coping in a Climate-Sensitive Population : A Qualitative Study. *International Journal of Environmental Research and Public Health*, 19(4), Article 4. <https://doi.org/10.3390/ijerph19042461>
- Ágoston, C., Urbán, R., Nagy, B., Csaba, B., Kőváry, Z., Kovács, K., Varga, A., Düll, A., Mónus, F., Shaw, C. A., & Demetrovics, Z. (2022). The psychological consequences of the ecological crisis : Three new questionnaires to assess eco-anxiety, eco-guilt, and ecological grief. *Climate Risk Management*, 37, 100441. <https://doi.org/10.1016/j.crm.2022.100441>

- Albrecht, G. (2005). « Solastalgia ». A New Concept in Health and Identity. *PAN: Philosophy Activism Nature*.  
<https://search.informit.org/doi/abs/10.3316/informit.897723015186456>
- Albrecht, G. (2011). Chronic Environmental Change : Emerging 'Psychoterratic' Syndromes. In I. Weissbecker (Éd.), *Climate Change and Human Well-Being* (p. 43-56). Springer New York.  
[https://doi.org/10.1007/978-1-4419-9742-5\\_3](https://doi.org/10.1007/978-1-4419-9742-5_3)
- Alisat, S., & Riemer, M. (2015). The environmental action scale : Development and psychometric evaluation. *Journal of Environmental Psychology*, 43, 13-23.  
<https://doi.org/10.1016/j.jenvp.2015.05.006>
- Berry, H. L., Waite, T. D., Dear, K. B. G., Capon, A. G., & Murray, V. (2018). The case for systems thinking about climate change and mental health. *Nature Climate Change*, 8(4), Article 4.  
<https://doi.org/10.1038/s41558-018-0102-4>
- Bourque, F., & Cunsolo Willox, A. (2014). Climate change : The next challenge for public mental health? *International Review of Psychiatry*, 26(4), Article 4.  
<https://doi.org/10.3109/09540261.2014.925851>
- Brick, C., Sherman, D. K., & Kim, H. S. (2017). "Green to be seen" and "brown to keep down" : Visibility moderates the effect of identity on pro-environmental behavior. *Journal of Environmental Psychology*, 51, 226-238. <https://doi.org/10.1016/j.jenvp.2017.04.004>
- Brosch, T. (2021). Affect and emotions as drivers of climate change perception and action : A review. *Current Opinion in Behavioral Sciences*, 42, 15-21. <https://doi.org/10.1016/j.cobeha.2021.02.001>
- Caillaud, S., Krauth-Gruber, S., & Bonnot, V. (2019). Facing Climate Change in France and Germany : Different Emotions Predicting the

- Same Behavioral Intentions? *Ecopsychology*, 11(1), 49-58.  
<https://doi.org/10.1089/eco.2018.0060>
- Cianconi, P., Hanife, B., Grillo, F., Betro', S., Lesmana, C. B. J., & Janiri, L. (2023). Eco-emotions and Psychoterratic Syndromes : Reshaping Mental HealthAssessment Under Climate Change. *The Yale Journal of Biology and Medicine*, 96(2), 211-226.  
<https://doi.org/10.59249/earx2427>
- Clayton, S. (2020). Climate anxiety : Psychological responses to climate change. *Journal of Anxiety Disorders*, 74, 102263.  
<https://doi.org/10.1016/j.janxdis.2020.102263>
- Clayton, S., & Karazsia, B. T. (2020). Development and validation of a measure of climate change anxiety. *Journal of Environmental Psychology*, 69, 101434.  
<https://doi.org/10.1016/j.jenvp.2020.101434>
- Clayton, S., Manning, C. M., Krygsman, K., & Speiser, M. (2017). *Mental health and our changing climate : Impacts, implications, and guidance*. American Psychological Association.  
<https://www.preventionweb.net/publication/mental-health-and-our-changing-climate-impacts-implications-and-guidance>
- Coffey, Y., Bhullar, N., Durkin, J., Islam, M. S., & Usher, K. (2021). Understanding Eco-anxiety : A Systematic Scoping Review of Current Literature and Identified Knowledge Gaps. *The Journal of Climate Change and Health*, 3, 100047.  
<https://doi.org/10.1016/j.joclim.2021.100047>
- Cunsolo, A., & Ellis, N. R. (2018). Ecological grief as a mental health response to climate change-related loss. *Nature Climate Change*, 8(4), Article 4. <https://doi.org/10.1038/s41558-018-0092-2>

- Doherty, T. J., & Clayton, S. (2011). The psychological impacts of global climate change. *American Psychologist*, 66(4), 265-276.  
<https://doi.org/10.1037/a0023141>
- Evers, A., Hagemeister, C., Høstmælingen, A., Lindley, P., Muñiz, J., & Sjöberg, A. (2013). *EFPA review model for the description and evaluation of psychological and educational tests : Test review form and notes for reviewers. Version 4.2.6*. European Federation of Psychologists' Associations.
- Fleury-Bahi, G., Pol, E., & Navarro, O. (2017). Introduction : Environmental Psychology and Quality of Life. In G. Fleury-Bahi, E. Pol, & O. Navarro (Éds.), *Handbook of Environmental Psychology and Quality of Life Research* (p. 1-8). Springer International Publishing. [https://doi.org/10.1007/978-3-319-31416-7\\_1](https://doi.org/10.1007/978-3-319-31416-7_1)
- French High Comitee for Climate. (2024). *Rapport Annuel 2024—Tenir le cap de la décarbonation, protéger la population*.
- Galway, L. P., & Beery, T. (2022). Exploring Climate Emotions in Canada's Provincial North. *Frontiers in Psychology*, 13, 920313.  
<https://doi.org/10.3389/fpsyg.2022.920313>
- Hair, J. F., Black, W., Anderson, R., & Babin, B. (2019). *Multivariate data analysis* (Eighth edition). Cengage.
- Hayes, K., Blashki, G., Wiseman, J., Burke, S., & Reifels, L. (2018). Climate change and mental health : Risks, impacts and priority actions. *International Journal of Mental Health Systems*, 12(1), 28.  
<https://doi.org/10.1186/s13033-018-0210-6>
- Helm, S. V., Li, X., Curran, M. A., & Barnett, M. A. (2022). Coping profiles in the context of global environmental threats : A person-centered approach. *Anxiety, Stress, & Coping*, 35(5), 609-622.  
<https://doi.org/10.1080/10615806.2021.2004132>



- Hogg, T. L., O'Brien, L. V., Scutt, K., Walker, I., Watsford, C. R., & Stanley, S. K. (2025). A person-centred approach to eco-anxiety dimensions : Presenting the mental wellbeing and behavioural characteristics of eco-anxiety profiles. In *Eco-anxiety: Exploring the psychological repercussions of ecological problems*.
- Hogg, T. L., Stanley, S. K., O'Brien, L. V., Wilson, M. S., & Watsford, C. R. (2021). The Hogg Eco-Anxiety Scale : Development and validation of a multidimensional scale. *Global Environmental Change*, 71, 102391. <https://doi.org/10.1016/j.gloenvcha.2021.102391>
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis : Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1-55. <https://doi.org/10.1080/10705519909540118>
- IPCC. (2022). *Climate Change 2022: Impacts, Adaptation and Vulnerability: Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*.
- Jalin, H., Chandès, C., Boudoukha, A.-H., Jacob, A., Poinot, R., & Congard, A. (2025). Better understanding eco-anxiety : Creation and validation of EMEA scale. *European Review of Applied Psychology*, 75(1), 101010. <https://doi.org/10.1016/j.erap.2024.101010>
- Jalin, H., Chandès, C., Congard, A., & Boudoukha, A.-H. (2024). Appréhender l'éco-anxiété : Une approche clinique et phénoménologique. *Psychologie Française*, 69, S0033298422000255. <https://doi.org/10.1016/j.psfr.2022.03.003>
- Jorgensen, T. D., Pornprasertmanit, S., Schoemann, A. M., Rosseel, Y., Miller, P., Quick, C., Garnier-Villarréal, M., Selig, J., Boulton, A., Preacher, K., Coffman, D., Rhemtulla, M., Robitzsch, A., Enders, C.,

- Arslan, R., Clinton, B., Panko, P., Merkle, E., Chesnut, S., ... Johnson, A. R. (2022). *semTools: Useful Tools for Structural Equation Modeling* (Version 0.5-6) [Logiciel]. <https://CRAN.R-project.org/package=semTools>
- Jürkenbeck, K., Spiller, A., & Schulze, M. (2021). Climate change awareness of the young generation and its impact on their diet. *Cleaner and Responsible Consumption*, 3, 100041. <https://doi.org/10.1016/j.clrc.2021.100041>
- Kácha, O., Vintř, J., & Brick, C. (2022). Four Europes : Climate change beliefs and attitudes predict behavior and policy preferences using a latent class analysis on 23 countries. *Journal of Environmental Psychology*, 81, 101815. <https://doi.org/10.1016/j.jenvp.2022.101815>
- Kaplan, E. A. (2020). Is Climate-Related Pre-Traumatic Stress Syndrome a Real Condition? *American Imago*, 77(1), Article 1. <https://doi.org/10.1353/aim.2020.0004>
- Kleres, J., & Wettergren, Å. (2017). Fear, hope, anger, and guilt in climate activism. *Social Movement Studies*, 16(5), 507-519. <https://doi.org/10.1080/14742837.2017.1344546>
- Landmann, H. (2020). Emotions in the context of environmental protection : Theoretical considerations concerning emotion types, eliciting processes, and affect generalization. In *Umweltpsychologie* (Vol. 24, Numéro 2, p. 61-73). <https://doi.org/10.31234/osf.io/yb2a7>
- Lim, W. M. (2024). A typology of validity : Content, face, convergent, discriminant, nomological and predictive validity. *Journal of Trade Science*, 12(3), 155-179. <https://doi.org/10.1108/JTS-03-2024-0016>
- Lowe, S. R., Manove, E. E., & Rhodes, J. E. (2013). Posttraumatic Stress and Posttraumatic Growth Among Low-Income Mothers who

- Survived Hurricane Katrina. *Journal of Consulting and Clinical Psychology*, 81(5), 877. <https://doi.org/10.1037/a0033252>
- Marczak, M., Wierzba, M., Kossowski, B., Marchewka, A., Morote, R., & Klöckner, C. A. (2024). Emotional responses to climate change in Norway and Ireland : A validation of the Inventory of Climate Emotions (ICE) in two European countries and an inspection of its nomological span. *Frontiers in Psychology*, 15. <https://doi.org/10.3389/fpsyg.2024.1211272>
- Marczak, M., Wierzba, M., Zaremba, D., Kulesza, M., Szczypiński, J., Kossowski, B., Budziszewska, M., Michałowski, J. M., Klöckner, C. A., & Marchewka, A. (2023). Beyond climate anxiety : Development and validation of the inventory of climate emotions (ICE): A measure of multiple emotions experienced in relation to climate change. *Global Environmental Change*, 83, 102764. <https://doi.org/10.1016/j.gloenvcha.2023.102764>
- Markle, G. L. (2013). Pro-Environmental Behavior : Does It Matter How It's Measured? Development and Validation of the Pro-Environmental Behavior Scale (PEBS). *Human Ecology*, 41(6), 905-914. <https://doi.org/10.1007/s10745-013-9614-8>
- Mathé, M., Grisetto, F., Gauvrit, N., & Roger, C. (2025). Psychometric validation of the French version of the Hogg Eco-Anxiety Scale (HEAS-FR). *Canadian Journal of Behavioural Science / Revue canadienne des sciences du comportement*, 57(1), 59-65. <https://doi.org/10.1037/cbs0000398>
- McMichael, A. J., Woodruff, R. E., & Hales, S. (2006). Climate change and human health : Present and future risks. *The Lancet*, 367(9513), Article 9513. [https://doi.org/10.1016/S0140-6736\(06\)68079-3](https://doi.org/10.1016/S0140-6736(06)68079-3)
- Meredith, W. (1993). Measurement invariance, factor analysis and factorial invariance. *Psychometrika*, 58(4), 525-543. <https://doi.org/10.1007/BF02294825>

- Metzen, D., Blumenschein, P., Peter, F., Bechtoldt, M., Frisch, A., Tschorn, M., & Heinzl, S. (2025). *Validation of the Inventory of Climate Emotions (ICE) in a German sample*. OSF.  
[https://doi.org/10.31234/osf.io/tcpem\\_v2](https://doi.org/10.31234/osf.io/tcpem_v2)
- Micoulaud-Franchi, J.-A., Coelho, J., Geoffroy, P. A., Vecchierini, M.-F., Poirot, I., Royant-Parola, S., Hartley, S., Cugy, D., Gronfier, C., Gauld, C., & Rey, M. (2024). Eco-anxiety : An adaptive behavior or a mental disorder? Results of a psychometric study. *L'Encéphale*.  
<https://doi.org/10.1016/j.encep.2023.08.009>
- Mokkink, L., Terwee, C., Patrick, D., Alonso, J., Stratford, P., Knol, D., Bouter, L., & de Vet, H. (2019). *COSMIN checklist manual*.
- Mouguiana-Daouda, C., Blanchard, M. A., Coussement, C., & Heeren, A. (2022). On the Measurement of Climate Change Anxiety : French Validation of the Climate Anxiety Scale. *Psychologica Belgica*, 62(1), Article 1. <https://doi.org/10.5334/pb.1137>
- Nairn, K. (2019). Learning from Young People Engaged in Climate Activism : The Potential of Collectivizing Despair and Hope. *YOUNG*, 27(5), 435-450.  
<https://doi.org/10.1177/1103308818817603>
- Nunnally, J. C. (1978). *Psychometric theory* (2d ed). McGraw-Hill.
- Oberski, D. (2016). Mixture Models : Latent Profile and Latent Class Analysis. In J. Robertson & M. Kaptein (Éds.), *Modern Statistical Methods for HCI* (p. 275-287). Springer International Publishing.  
[https://doi.org/10.1007/978-3-319-26633-6\\_12](https://doi.org/10.1007/978-3-319-26633-6_12)
- Ogunbode, C. A., Doran, R., Hanss, D., Ojala, M., Salmela-Aro, K., van den Broek, K. L., Bhullar, N., Aquino, S. D., Marot, T., Schermer, J. A., Wlodarczyk, A., Lu, S., Jiang, F., Maran, D. A., Yadav, R., Ardi, R., Chegeni, R., Ghanbarian, E., Zand, S., ... Karasu, M. (2022). Climate anxiety, wellbeing and pro-environmental action : Correlates of

- negative emotional responses to climate change in 32 countries. *Journal of Environmental Psychology*, 84, 101887.  
<https://doi.org/10.1016/j.jenvp.2022.101887>
- Ogunbode, C. A., Pallesen, S., Böhm, G., Doran, R., Bhullar, N., Aquino, S., Marot, T., Schermer, J. A., Wlodarczyk, A., Lu, S., Jiang, F., Salmela-Aro, K., Hanss, D., Maran, D. A., Ardi, R., Chegeni, R., Tahir, H., Ghanbarian, E., Park, J., ... Lomas, M. J. (2021). Negative emotions about climate change are related to insomnia symptoms and mental health : Cross-sectional evidence from 25 countries. *Current Psychology*. <https://doi.org/10.1007/s12144-021-01385-4>
- Ojala, M. (2012a). Hope and climate change : The importance of hope for environmental engagement among young people. *Environmental Education Research*, 18(5), 625-642.  
<https://doi.org/10.1080/13504622.2011.637157>
- Ojala, M. (2012b). How do children cope with global climate change? Coping strategies, engagement, and well-being. *Journal of Environmental Psychology*, 32(3), 225-233.  
<https://doi.org/10.1016/j.jenvp.2012.02.004>
- Pihkala, P. (2020a). Anxiety and the Ecological Crisis : An Analysis of Eco-Anxiety and Climate Anxiety. *Sustainability*, 12(19), Article 19.  
<https://doi.org/10.3390/su12197836>
- Pihkala, P. (2020b). Eco-Anxiety and Environmental Education. *Sustainability*, 12(23), Article 23.  
<https://doi.org/10.3390/su122310149>
- Pihkala, P. (2022). Toward a Taxonomy of Climate Emotions. *Frontiers in Climate*, 3.  
<https://www.frontiersin.org/articles/10.3389/fclim.2021.738154>

- Pitt, C., Norris, K., & Pecl, G. (2023). A Systematic Review of Climate Emotions and Mental Health in Adults. *Global Environmental Psychology, 1*, 1-40. <https://doi.org/10.5964/gep.11405>
- Putnick, D. L., & Bornstein, M. H. (2016). Measurement Invariance Conventions and Reporting : The State of the Art and Future Directions for Psychological Research. *Developmental review : DR, 41*, 71-90. <https://doi.org/10.1016/j.dr.2016.06.004>
- Reser, J. P., Morrissey, S. A., & Ellul, M. (2011). The Threat of Climate Change : Psychological Response, Adaptation, and Impacts. In I. Weissbecker (Éd.), *Climate Change and Human Well-Being* (p. 19-42). Springer New York. [https://doi.org/10.1007/978-1-4419-9742-5\\_2](https://doi.org/10.1007/978-1-4419-9742-5_2)
- Revelle, W. (2023). *psych : Procedures for Psychological, Psychometric, and Personality Research* (Version 2.3.3) [Logiciel]. <https://CRAN.R-project.org/package=psych>
- Reyes, M. E. S., Carmen, B. P. B., Luminarias, M. E. P., Mangulabnan, S. A. N. B., & Ogunbode, C. A. (2021). An investigation into the relationship between climate change anxiety and mental health among Gen Z Filipinos. *Current Psychology*. <https://doi.org/10.1007/s12144-021-02099-3>
- Rhead, R., Elliot, M., & Upham, P. (2018). Using latent class analysis to produce a typology of environmental concern in the UK. *Social Science Research, 74*, 210-222. <https://doi.org/10.1016/j.ssresearch.2018.06.001>
- Rice, K., Usher, K., Schutte, N. S., Austin, E., Patrick, R., Fatema, S. R., Kabir, H., Rock, A. J., Jones, R., & Davies, R. L. (2025). Eco-emotions : Validation of the multi-dimensional inventory of climate emotions in an Australian sample. *Frontiers in Climate, 7*. <https://doi.org/10.3389/fclim.2025.1560820>

- Rosenberg, J. M., Beymer, P. N., Anderson, D. J., Lissa, C. j van, & Schmidt, J. A. (2019). tidyLPA : An R Package to Easily Carry Out Latent Profile Analysis (LPA) Using Open-Source or Commercial Software. *Journal of Open Source Software*, 3(30), 978.  
<https://doi.org/10.21105/joss.00978>
- Rosseel, Y., Jorgensen, T. D., Rockwood, N., Oberski, D., Byrnes, J., Vanbrabant, L., Savalei, V., Merkle, E., Hallquist, M., Rhemtulla, M., Katsikatsou, M., Barendse, M., Scharf, F., & Du, H. (2023). *lavaan : Latent Variable Analysis* (Version 0.6-15) [Logiciel]. <https://CRAN.R-project.org/package=lavaan>
- Sampaio, F., Costa, T., Teixeira-Santos, L., de Pinho, L. G., Sequeira, C., Luís, S., Loureiro, A., Soro, J. C., Roldán Merino, J., Moreno Poyato, A., Peña Loray, J. S., Rodríguez Quiroga, A., O'Brien, L. V., Hogg, T. L., & Stanley, S. K. (2023). Validating a measure for eco-anxiety in Portuguese young adults and exploring its associations with environmental action. *BMC Public Health*, 23(1), 1905.  
<https://doi.org/10.1186/s12889-023-16816-z>
- Sapin, A., Anais, A., Clayton, S., Bujard, V., Jalin, H., & Fleury-Bahi, G. (2025). *“With all these feelings, I just can’t stay passive”: An exploration of eco-emotions, political attitude, perceived injustice and pro-environmental behaviors among young adults in France*. OSF. [https://doi.org/10.31234/osf.io/h7f4r\\_v1](https://doi.org/10.31234/osf.io/h7f4r_v1)
- Sciberras, E., & Fernando, J. W. (2022). Climate change-related worry among Australian adolescents : An eight-year longitudinal study. *Child and Adolescent Mental Health*, 27(1), 22-29.  
<https://doi.org/10.1111/camh.12521>
- Stanley, S. K., Hogg, T. L., 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>

Sutter, P.-E., Chamberlain, S., & Messmer, L. (2025). *Eco-anxiété en France (Etude 2025)*. ADEME.

Tschakert, P., Ellis, N. R., Anderson, C., Kelly, A., & Obeng, J. (2019). One thousand ways to experience loss : A systematic analysis of climate-related intangible harm from around the world. *Global Environmental Change, 55*, 58-72.  
<https://doi.org/10.1016/j.gloenvcha.2018.11.006>

Van Valkengoed, A. M., Steg, L., & Perlaviciute, G. (2021). Development and validation of a climate change perceptions scale. *Journal of Environmental Psychology, 76*, 101652.  
<https://doi.org/10.1016/j.jenvp.2021.101652>

van Zomeren, M., Spears, R., & Leach, C. W. (2010). Experimental evidence for a dual pathway model analysis of coping with the climate crisis. *Journal of Environmental Psychology, 30*(4), 339-346.  
<https://doi.org/10.1016/j.jenvp.2010.02.006>

Veijonaho, S., Ojala, M., Hietajärvi, L., & Salmela-Aro, K. (2024). Profiles of climate change distress and climate denialism during adolescence : A two-cohort longitudinal study. *International Journal of Behavioral Development, 48*(2), 103-112.  
<https://doi.org/10.1177/01650254231205251>

Wesley Schultz, P. (2001). THE STRUCTURE OF ENVIRONMENTAL CONCERN : CONCERN FOR SELF, OTHER PEOPLE, AND THE BIOSPHERE. *Journal of Environmental Psychology, 21*(4), Article 4.  
<https://doi.org/10.1006/jevp.2001.0227>

Wullenkord, M. C., Johansson, M., Loy, L. S., Menzel, C., & Reese, G. (2024). Go out or stress out? Exploring nature connectedness and



cumulative stressors as resilience and vulnerability factors in different manifestations of climate anxiety. *Journal of Environmental Psychology*, 95, 102278.

<https://doi.org/10.1016/j.jenvp.2024.102278>

## **6. SUPPLEMENTARY MATERIAL**

**Appendix A.** Item list of the scales used in the study – In French and in English

**Appendix A-1.** Inventory of Climate Emotion (Marczak, Wierzba, et al., 2023; Marczak et al., 2024)

### **ANGER**

1. Je me sens en colère que le système politique et économique dans lequel nous vivons nuit au climat. / I feel angry that the political and economic system that we live in harms the climate.
2. Je suis indigné.e que les politicien.nes aient permis au changement climatique d’aller si loin. / I am outraged that politicians allowed climate change to come this far.
3. Je me sens indigné.e par les entreprises qui nuisent au climat. / I feel outraged at corporations that harm the climate.
4. Je ressens de la colère lorsque je pense aux représentant.e-s politiques qui retardent les efforts pour atténuer le changement climatique. / I feel anger when I think of politicians who delay efforts to mitigate climate change.

### **ANXIETY**

1. Penser au changement climatique me fait craindre pour l’avenir de nos enfants. / Thinking about climate change makes me fear for the future of our children.
2. Je suis submergé.e par l’imminence de la catastrophe climatique. / I am overwhelmed by the awareness of the approaching climate disaster.
3. Tout semble incertain à cause du changement climatique. / Everything seems uncertain because of climate change.
4. J’ai peur de la manière dont le changement climatique m’affectera moi et mes proches. / I fear how climate change will affect me and my loved ones.

### **SORROW**

1. La pensée que tant d’espèces s’éteignent sous la pression du changement climatique me remplit de chagrin. / The thought of so many species going extinct under the pressure of climate change fills me with sorrow.

2. La pensée que le monde que je connais est en train de disparaître pour toujours à cause du changement climatique me rend triste. / The thought that the world I know is disappearing forever because of climate change makes me sad.

3. Je me sens attristé·e que nous perdions à jamais des possibilités à cause du changement climatique. / I feel sorry about the possibilities we are losing forever because of climate change.

4. Je suis triste que tant d'êtres vivants souffrent à cause du changement climatique. / I am sad that so many living creatures suffer because of climate change.

### **ISOLATION**

1. Je me sens être une des seules personnes qui comprend réellement ce qu'implique le changement climatique. / I feel like one of the few people who actually understand what climate change entails.

2. Je me sens seul·e car la plupart des gens autour de moi ne se préoccupent pas autant que moi du changement climatique / I feel lonely because most of the people around me don't care about climate change as much as I do.

3. Je me sens seul·e car c'est difficile de parler de mes inquiétudes concernant le changement climatique avec d'autres personnes. / I feel lonely because it's difficult to talk about my climate change concerns with other people.

4. Je me sens à part puisque la société considère l'inquiétude liée au changement climatique comme quelque chose d'étrange. / I feel alienated because society considers concern for climate change as something strange.

### **GUILT**

1. J'ai mauvaise conscience de ne pas faire suffisamment pour atténuer le changement climatique. / I have a guilty conscience about not doing enough to mitigate climate change.

2. Je suis contrarié·e d'avoir un gros impact négatif sur le climat. / It upsets me that I have a big negative impact on the climate.

3. Je me sens coupable que mon mode de vie contribue au changement climatique. / I feel guilty that my lifestyle contributes to climate change.

4. Je suis en colère contre moi-même de ne pas faire assez pour limiter mon impact négatif sur le climat. / I am angry at myself for not doing enough to limit my negative impact on the climate.

### **POWERLESSNESS**

1. Je me sens confus.e concernant ce que je peux faire pour réduire le changement climatique. / I feel confused about what I can do to reduce climate change.

2. Je me sens dépassé.e par le nombre d'aspects de la vie qui devraient être changés pour limiter le changement climatique. / I am overwhelmed by how many aspects of life would need to be changed to limit climate change.

3. En tant qu'individu, je me sens impuissant.e sur ce qui se passe vis-à-vis du climat. / As an individual, I feel powerless with little agency over what happens with the climate.

4. Je me sens impuissant.e quand je pense à quel point il est difficile de vivre en respectant le climat. / I feel helpless when I think of how difficult it is to live in a climate-friendly way.

### **HOPE/ENTHUSIASM**

1. L'engagement croissant du public envers le changement climatique me donne de l'espoir. / The increasing public engagement with climate change gives me hope.

2. Je crois qu'il y a des solutions émergentes qui nous permettront d'arrêter le changement climatique. / I believe that there are emerging solutions that will allow us to stop climate change.

3. Les actions concrètes pour le climat me permettent d'être optimiste par rapport au futur. / Concrete actions for the climate allow me to be optimistic about the future.

4. La mobilisation sociale concernant le combat contre le changement climatique me fait ressentir qu'ensemble nous pouvons atteindre cet objectif. / Social mobilisation in the fight against climate change makes me feel that together we can achieve this goal.

### **CONTEMPT**

1. Cela m'agace de voir les gens succomber à l'hystérie climatique. / It annoys me to watch people succumb to climate hysteria.
2. Je suis agacé.e par la communication constante autour du changement climatique. / I am annoyed by the constant publicity around climate change.
3. J'en ai assez d'entendre parler du changement climatique. / I am bored of hearing about climate change.
4. Je suis surpris.e que des gens font l'expérience d'émotions fortes en lien avec le changement climatique. / I am surprised that people experience strong emotions in connection with climate change.

**Appendix A-2.** Climate Anxiety Scale (Clayton & Karazsia, 2020; Mouguiama-Daouda et al., 2022)

1. Mes préoccupations au sujet du changement climatique m'empêchent de m'amuser avec ma famille ou mes amis. / My concerns about climate change make it hard for me to have fun with my family or friends.
2. Je me mets à l'écart et pense aux raisons pour lesquelles je me sens ainsi face au changement climatique. / I go away by myself and think about why I feel this way about climate change.
3. Mes préoccupations à propos du changement climatique interfèrent avec ma capacité à faire mon travail ou mes tâches scolaires. / My concerns about climate change interfere with my ability to get work or school assignments done.
4. Il m'est difficile de me concentrer lorsque je pense au changement climatique. / Thinking about climate change makes it difficult for me to concentrate.
5. Mes préoccupations concernant le changement climatique impactent négativement ma capacité à exploiter pleinement mon potentiel. / My concerns about climate change undermine my ability to work to my potential.
6. Je me retrouve à pleurer à cause du changement climatique. / I find myself crying because of climate change.
7. J'écris mes réflexions sur le changement climatique et je les analyse. / I write down my thoughts about climate change and analyze them.
8. Je fais des cauchemars à propos du changement climatique. / I have nightmares about climate change.
9. Il m'est difficile de m'endormir lorsque je pense au changement climatique. / Thinking about climate change makes it difficult for me to sleep.
10. J'ai du mal à trouver un équilibre entre mes préoccupations pour le « durable » et ma vie personnelle. / I have problems balancing my concerns about sustainability with the needs of my family.

11. Je me demande pourquoi est-ce que je n'arrive pas à mieux gérer le changement climatique. / I think, "why can't I handle climate change better?".

12. Je me demande pourquoi je réagis ainsi au changement climatique. / I think, "why do I react to climate change this way?"

13. Mes amis disent que je pense trop au changement climatique. / My friends say I think about climate change too much.

**Appendix A-3.** Climate Change Perceptions Scale (Van Valkengoed et al., 2021)

1. Je pense que le changement climatique est une réalité. / I believe that climate change is real.
2. La cause principale du changement climatique sont les activités humaines. / The main causes of climate change are human activities.
3. Le changement climatique va entraîner de graves conséquences négatives. / Climate change will bring about serious negative consequences.



**Appendix A-4.** Proenvironmental Behaviors Scale (Brick et al., 2017; Markle, 2013)

1. A quelle fréquence éteignez-vous les lumières quand vous quittez une pièce ? / How often do you turn off the lights when leaving a room?
2. A quelle fréquence éteignez-vous les appareils électroménagers ou électroniques plutôt que de les mettre en mode veille ? / How often do you switch off standby modes of appliances or electronic devices?
3. A quelle fréquence diminuez-vous le chauffage ou la climatisation pour limiter la consommation d'énergie ? / How often do you cut down on heating or air conditioning to limit energy use?
4. A quelle fréquence éteignez-vous les écrans (télévision, ordinateurs) lorsque vous quittez une pièce ? / How often do you turn off the TV when leaving a room?
5. A quelle fréquence limitez-vous le temps passé dans la douche afin de conserver l'eau ? / How often do you limit your time in the shower in order to conserve water?
6. A quelle fréquence attendez-vous que le lave-linge ou le lave-vaisselle soient pleins pour les utiliser ? / How often do you wait until you have a full load to use the washing machine or dishwasher?
7. Lorsque vous achetez des habits, à quelle fréquence viennent-il de friperies ou de marques éco-responsables ? / When you buy clothing, how often is it from thrift stores or from environmentally friendly brands?
8. A quelle fréquence mangez-vous de la viande ? / How often do you eat meat?
9. A quelle fréquence mangez-vous des produits d'origine animale comme du lait, du fromage, des œufs ou du yaourt ? / How often do you eat dairy products such as milk, cheese, eggs, or yogurt?
10. A quelle fréquence mangez-vous de la nourriture biologique ? / How often do you eat organic food?
11. A quelle fréquence mangez-vous de la nourriture locale ? / How often do you eat local food (produced within 100 miles)?
12. Au cours de l'année écoulée, à quelle fréquence avez-vous fait du covoiturage ? / During the past year how often have you car-pooled?

13. Au cours de l'année écoulée, à quelle fréquence avez-vous utilisé les transports en commun ? / During the past year how often have you used public transportation?

14. Au cours de l'année écoulée, à quelle fréquence avez-vous marché ou utilisé le vélo au lieu de conduire ? / During the past year how often have you walked or cycled instead of driving?

## **Appendix A-5. Environmental Action Scale (Alisat & Riemer, 2015)**

### **PARTICIPATORY ACTIONS**

1. Je me suis éduqué·e concernant des enjeux environnementaux (e.g., à travers les médias, la télévision, internet, des blogs, etc.). / Educated myself about environmental issues (e.g., through media, television, internet, blogs, etc.)

2. J'ai participé à un évènement éducatif (e.g. atelier) en lien avec l'environnement. / Participated in an educational event (e.g., workshop) related to the environment.

4. J'ai parlé des enjeux environnementaux avec d'autres personnes (e.g., conjoint.e, partenaire, parent(s), enfants, ou ami.es). / Talked with others about environmental issues (e.g., spouse, partner, parent(s), children, or friends).

5. J'ai utilisé des outils en ligne (e.g., YouTube, Facebook, Twitter/X, Instagram, TikTok) pour sensibiliser autrui aux enjeux environnementaux. / Used online tools (e.g., YouTube, Facebook, Wikipedia, MySpace Blogs) to raise awareness about environmental issues.

8. Je me suis impliqué·e dans un groupe environnemental ou un parti politique. / Became involved with an environmental group or political party (e.g., volunteer, summer job, etc.).

9. J'ai soutenu financièrement une cause environnementale. / Financially supported an environmental cause. .

14. J'ai sciemment pris du temps pour travailler sur les enjeux environnementaux (e.g., travailler à temps partiel pour consacrer du temps à des activités environnementales, occuper un emploi en lien avec l'environnement, ou choisir des activités environnementales plutôt que d'autres activités de loisirs). / Consciously made time to be able to work on environmental issues (e.g., working part time to allow time for environmental pursuits, working in an environmental job, or choosing environmental activities over other leisure activities).

15. J'ai participé à un évènement communautaire axé sur la sensibilisation à l'environnement. / Participated in a community event which focused on environmental awareness.

17.J'ai participé à des efforts de conservation de la nature (e.g., planter des arbres, ramasser des déchets, restaurer des cours d'eau). / Participated in nature conservation efforts (e.g., planting trees, restoration of waterways).

18.J'ai passé du temps à travailler avec un groupe/une organisation qui s'intéresse au lien entre l'environnement et d'autres questions de société telles que la justice ou la pauvreté. / Spent time working with a group/organization that deals with the connection of the environment to other societal issues such as justice or poverty.

### **LEADERSHIP ACTIONS**

3.J'ai organisé un événement éducatif (e.g. atelier) en lien avec l'environnement. / Organized an educational event (e.g., workshop) related to environmental issues.

6.J'ai utilisé des méthodes traditionnelles (e.g., lettres à une rédaction, articles) pour sensibiliser autrui aux enjeux environnementaux. / Used traditional methods (e.g., letters to the editor, articles) to raise awareness about environmental issues.

7.J'ai écrit personnellement ou appelé un·e représentant·e politique ou du gouvernement concernant un enjeu environnemental. / Personally wrote to or called a politician/government official about an environmental issue.

10.J'ai participé à une manifestation/un rassemblement concernant un enjeu environnemental. / Took part in a protest/rally about an environmental issue. .

11.J'ai organisé une manifestation/un rassemblement en lien avec l'environnement. / Organized an environmental protest/rally.

12.J'ai organisé un boycott contre une entreprise impliquée dans des pratiques néfastes pour l'environnement. / Organized a boycott against a company engaging in environmentally harmful practices.

13.J'ai organisé une pétition (y compris pétitions en ligne) concernant un enjeu environnemental. / Organized a petition (including online petitions) for an environmental cause.

16.J'ai organisé un évènement communautaire axé sur la sensibilisation à l'environnement. / Organized a community event which focused on environmental awareness.

**Appendix B.** Psychometric evaluation of the scale used to test nomological validity

**Appendix B-1.** Psychometric evaluation of the *Climate Anxiety Scale* (Clayton & Karazsia, 2020; Mouguiama-Daouda et al., 2022)

**Table B-1-1.** Internal consistency (Cronbach's  $\alpha$  and McDonald's  $\omega$ ) and structural validity (Confirmatory Factor Analysis : CFI, TLI, RMSEA, SRMR) indicators

Cronbach's $\alpha$	McDonald's $\omega$	CFI	TLI	RMS EA	SRM R
.88	.89	.965	.958	.077	.053

**Table B-1-2.** Factor loadings of the scale's Confirmatory Factor Analysis

Item	$\beta$	$\beta$ - IC95%	p- valeur
1. Mes préoccupations au sujet du changement climatique m'empêchent de m'amuser avec ma famille ou mes amis.	.850	[.831,.870]	<.001
2. Je me mets à l'écart et pense aux raisons pour lesquelles je me sens ainsi face au changement climatique.	.853	[.834,.873]	<.001
3. Mes préoccupations à propos du changement climatique interfèrent avec ma capacité à faire mon travail ou mes tâches scolaires.	.777	[.747,.808]	<.001
4. Il m'est difficile de me concentrer lorsque je pense au changement climatique.	.767	[.737,.798]	<.001
5. Mes préoccupations concernant le changement climatique impactent négativement ma capacité à exploiter pleinement mon potentiel.	.569	[.530,.609]	<.001
6. Je me retrouve à pleurer à cause du changement climatique.	.675	[.638,.711]	<.001
7. J'écris mes réflexions sur le changement climatique et je les analyse.	.495	[.441,.549]	<.001
8. Je fais des cauchemars à propos du changement climatique.	.423	[.373,.474]	<.001
9. Il m'est difficile de m'endormir lorsque je pense au changement climatique.	.768	[.740,.796]	<.001
10. J'ai du mal à trouver un équilibre entre mes préoccupations pour le « durable » et ma vie personnelle.	.623	[.587,.658]	<.001
11. Je me demande pourquoi est-ce que je n'arrive pas à mieux gérer le changement climatique.	.803	[.777,.828]	<.001
12. Je me demande pourquoi je réagis ainsi au changement climatique.	.803	[.779,.827]	<.001
13. Mes amis disent que je pense trop au changement climatique.	.600	[.556,.644]	<.001

**Appendix B-2.** Psychometric evaluation of the adaptation of the *Climate Change Perceptions Scale* (Van Valkengoed et al., 2021)

**Table B-2-1.** Internal consistency (Cronbach's  $\alpha$  and McDonald's  $\omega$ ) and structural validity (Confirmatory Factor Analysis : CFI, TLI, RMSEA, SRMR) indicators

Cronbach's $\alpha$	McDonald's $\omega$	CFI	TLI	RMS EA	SRMR
.82	.82	$\approx 1.00$	$\approx 1.00$	>.001	>.001

**Table B-2-2.** Factor loadings of the scale's Confirmatory Factor Analysis

Item	$\beta$	$\beta$ - IC95%	p-value
1. Je pense que le changement climatique est une réalité.	.914	[.877,.951]	<.001
2. La cause principale du changement climatique sont les activités humaines.	.878	[.844,.913]	<.001
3. Le changement climatique va entraîner de graves conséquences négatives.	.895	[.864,.895]	<.001

**Appendix B-3.** Psychometric evaluation of the adaptation of the *Proenvironmental Behavior Scale* (Brick et al., 2017; Markle, 2013)

**Table B-3-1.** Internal consistency (Cronbach's  $\alpha$  and McDonald's  $\omega$ ) and structural validity (Confirmatory Factor Analysis : CFI, TLI, RMSEA, SRMR) indicators

Cronbach's $\alpha$	McDonald's $\omega$	CFI	TLI	RMS EA	SRM R
.64	.64	.926	.902	.056	.060

**Table B-3-2.** Factor loadings of the scale's Confirmatory Factor Analysis

Item	$\beta$	$\beta$ - IC95%	p- valeur
2. A quelle fréquence éteignez-vous les appareils électroménagers ou électroniques plutôt que de les mettre en mode veille ?	.297	[.239,.354]	<.001
3. A quelle fréquence diminuez-vous le chauffage ou la climatisation pour limiter la consommation d'énergie ?	.480	[.423,.536]	<.001
4. A quelle fréquence éteignez-vous les écrans (télévision, ordinateurs) lorsque vous quittez une pièce ?	.317	[.258,.376]	<.001
5. A quelle fréquence limitez-vous le temps passé dans la douche afin de conserver l'eau ?	.425	[.371,.479]	<.001
7. Lorsque vous achetez des habits, à quelle fréquence viennent-il de friperies ou de marques éco-responsables ?	.609	[.554,.665]	<.001
8. A quelle fréquence mangez-vous de la viande ?	.472	[.417,.528]	<.001
9. A quelle fréquence mangez-vous des produits d'origine animale comme du lait, du fromage, des œufs ou du yaourt ?	.310	[.246,.374]	<.001
1. A quelle fréquence mangez-vous de la nourriture biologique ?	.301	[.242,.361]	<.001
11. A quelle fréquence mangez-vous de la nourriture locale ?	.300	[.242,.358]	<.001
12. Au cours de l'année écoulée, à quelle fréquence avez-vous fait du covoiturage ?	.281	[.223,.340]	<.001
13. Au cours de l'année écoulée, à quelle fréquence avez-vous utilisé les transports en commun ?	.173	[.109,.237]	<.001
14. Au cours de l'année écoulée, à quelle fréquence avez-vous marché ou utilisé le vélo au lieu de conduire ?	.339	[.282,.397]	<.001

*Notes : Notes: Item 1 and item 6 have been excluded from the model and score calculation due to very high abnormality (kurtosis=4.75 and 9.94). In addition, residual correlations are added between items 10 and 11, 8 and 9, 13 and 14, 2 and 4.*



**Appendix B-4.** Psychometric evaluation of the adaptation of the *l'Environmental Action Scale Scale* (Alisat & Riemer, 2015)

**Table B-4-1.** Internal consistency (Cronbach's  $\alpha$  and McDonald's  $\omega$ ) and structural validity (Confirmatory Factor Analysis : CFI, TLI, RMSEA, SRMR) indicators

Cronbach's $\alpha$		McDonald's $\omega$		CFI	TLI	RMS EA	SRM R
P.A.	L.A.	P.A.	L.A.				
.84	.75	.90	.88	.925	.914	.074	.080

**Table B-4-2.** Factor loadings of the scale's Confirmatory Factor Analysis

Dimension	Item	$\beta$	$\beta$ - IC95%	p-valeur
<b>Participatory actions</b>	1.Je me suis éduqué·e concernant des enjeux environnementaux (e.g., à travers les médias, la télévision, internet, des blogs, etc.).	.644	[.604,.683]	<.001
	2.J'ai participé à un évènement éducatif (e.g. atelier) en lien avec l'environnement.	.730	[.701,.759]	<.001
	4.J'ai parlé des enjeux environnementaux avec d'autres personnes (e.g., conjoint.e, partenaire, parent(s), enfants, ou ami.es).	.732	[.702,.762]	<.001
	5.J'ai utilisé des outils en ligne (e.g., YouTube, Facebook, Twitter/X, Instagram, TikTok) pour sensibiliser autrui aux enjeux environnementaux.	.658	[.622,.695]	<.001
	8.Je me suis impliqué·e dans un groupe environnemental ou un parti politique.	.716	[.672,.759]	<.001
	9.J'ai soutenu financièrement une cause environnementale.	.529	[.483,.575]	<.001
	14.J'ai sciemment pris du temps pour travailler sur les enjeux environnementaux (e.g., travailler à temps partiel pour consacrer du temps à des activités environnementales, occuper un emploi en lien avec l'environnement, ou choisir des activités environnementales plutôt que d'autres activités de loisirs).	.761	[.726,.796]	<.001
	15.J'ai participé à un évènement communautaire axé sur la sensibilisation à l'environnement.	.783	[.753,.812]	<.001
	17.J'ai participé à des efforts de conservation de la nature (e.g., planter des arbres, ramasser des déchets, restaurer des cours d'eau).	.541	[.498,.585]	<.001
<b>Leadership actions</b>	18.J'ai passé du temps à travailler avec un groupe/une organisation qui s'intéresse au lien entre l'environnement et d'autres questions de société telles que la justice ou la pauvreté.	.771	[.738,.805]	<.001
	3.J'ai organisé un évènement éducatif (e.g. atelier) en lien avec l'environnement.	.825	[.791,.859]	<.001
	6.J'ai utilisé des méthodes traditionnelles (e.g., lettres à une rédaction, articles) pour sensibiliser autrui aux enjeux environnementaux.	.736	[.689,.783]	<.001
	7.J'ai écrit personnellement ou appelé un·e représentant·e politique ou du gouvernement concernant un enjeu environnemental.	.733	[.673,.793]	<.001

---

1.J'ai participé à une manifestation/un rassemblement concernant un enjeu environnemental.	.752	[.718,.786]	<.001
11.J'ai organisé une manifestation/un rassemblement en lien avec l'environnement.	.769	[.711,.828]	<.001
12.J'ai organisé un boycott contre une entreprise impliquée dans des pratiques néfastes pour l'environnement.	.395	[.330,.460]	<.001
13.J'ai organisé une pétition (y compris pétitions en ligne) concernant un enjeu environnemental.	.460	[.383,.537]	<.001
16.J'ai organisé un évènement communautaire axé sur la sensibilisation à l'environnement	.836	[.792,.881]	<.001

---

## **Appendix C. Technical note regarding CFA and invariance analysis computation and evaluation.**

### **Appendix C-1.** Regarding CFA computation and evaluation.

We would like to provide some additional details on the parameterization of the Confirmatory Factor Analysis model of the ICE. Indeed, the factor model initially considers the variables, i.e. the responses to the scale items, as continuous variables. This is problematic, since most psychological scales, including the ICE, use Likert scales, with the main consequence that the items are ordinal variables. Here, they are ordinal variables ranging from 1 to 5. This specificity is taken into account by Lavaan's ordered=T argument, which has several effects. The first is to choose Weighted Least Squares Mean and Variance Adjusted (WLSMV) as the estimation method, which is a more robust version (Kline, 2011) of the *Weighted Least Squares*, considered the most suitable estimator for ordinal data (Brown, 2006). However, this does not solve the main problem, which is that the manifest variables of the model, i.e. the items, are not continuous variables. If we wish to analyze ordinal variables within the paradigm of the common factor model, we can turn to Item Factor Analysis (IFA)(Beaujean, 2014). This approach considers that a measured ordinal variable is the expression of a continuous underlying latent variable (specific to the item, to be distinguished from the common latent factor) that we have only partially observed. The relationship between the measured variable  $y$  and the underlying latent variable  $y^*$  is established via a threshold model; i.e., we assume that:

Using the probit link function, we obtain continuous latent variables  $y^*$  that follow a centered-reduced normal distribution (Cai & Moustaki, 2018). These  $y^*$  are then used to model common latent factors, using the common factor model approach. The final parameter to be set when modeling a CFA is to solve identifiability problems. Indeed, any model that incorporates latent variables is unidentifiable, in the sense that the number of parameters to be estimated is greater than the amount of information available, since the latent phenomenon is not in the data. Usually, two solutions are available: the first is to arbitrarily set the first factor loading of each latent factor to 1; the second is to constrain each latent factor to be centered-reduced, i.e. an intercept of 0 and a variance of 1. In the context of a psychometric study, we prefer the second method, considering that examining all factor loadings is more important than the level and variance of the sample on latent factors.

Regarding model fit, it is assessed as follows (Hu & Bentler, 1999) It is considered acceptable if the Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) are greater than .90, and the Root Mean Square Error of Approximation (RMSEA) and Standardized Root Mean Square Residual (SRMR) are less than .080; and satisfactory if the CFI and TLI are  $\geq .95$ , and the RMSEA and SRMR are  $\leq .06$ . We also examine factor loadings to ensure that each item is well “explained” by the existence of the latent factor ( expecting a value greater than .50, Hair et al., 2019).

**Appendix C-2.** Regarding Invariance analysis computation and evaluation.

As said in the main manuscript and in line with the literature (Putnick & Bornstein, 2016), three levels of invariance were successively tested: configural invariance (a multi-group factor model is examined without constraints), metric invariance (factor loadings are constrained to be equal between groups or between measurement times), and scalar invariance (addition of an equality constraint on the intercepts...but not here). Indeed, *The Item Factor Analysis* mentioned earlier also involves an adjustment to the invariance analysis. This adjustment concerns the level of scalar invariance, which corresponds to the fact that the level of an item has the same meaning with regard to the latent construct between groups or over

time. In mathematical terms, this corresponds to the application, in addition to the constraints set out earlier, of an equality constraint on item intercepts. When working with ordinal variables and using the Item Factor Approach to model ordinal items as continuous latent variables, we will apply the constraint on the thresholds  $\tau$  that allow the estimation of  $y^*$ , as all  $y^*$  are modeled as perfectly normal variables.

In terms of interpretation and fit evaluation, the configurational model “only” tests whether a multi-group model has a good fit to the data, while the metric model will examine whether each item contributes to the latent factor in the same way between groups. Finally, the scalar model investigates whether the level of an item has the same significance in relation to the latent factor. If we take the example of a measure of depression, scalar invariance would mean assessing whether the fact of crying regularly provides the same information on the clinical state whether one is a woman or a man. An invariance problem is identified when too much variation in fit is observed when constraints are successively imposed. A problem situation is considered to exist when CFI or TLI decreases by more than .010, RMSEA increases by more than .015 or SRMR increases by .030 (for metric invariance) or .010 (for scalar invariance)(Chen, 2007).

#### **Appendix D.** Nomological validity: summary table of expected correlations.

	Anger	Contem pt	Hope/ enthusia sm	Powerless ness	Guilt	Isolatio n	Anxiet y	Sorrow
Clinical eco-anxiety	+	-	.	+	+	+	+	+
Environmental awareness	+	-	.	.	+	.	+	+
Connectedness to nature	+	-	.	.	+	.	+	+
Political Orientation	-	+	.	.	.	.	+	.
PEB - daily	+	-	+	-	+	.	+	+
PEB - politic participatory action	+	-	+	-	+	.	+	+
PEB - politic leadership actions	+	-	+	-	+	.	+	+

*Notes: “+” means that a positive and significant correlation is expected, “-” that a negative and significant correlation is expected, “.” that no prior expectation has been formulated.*

The expectations we have formulated are mainly drawn on both the literature and the nomological span proposed by Marczak et al. (2024).

**Clinical eco-anxiety:** it seems appropriate to consider that many of the negative emotions (Anger, Powerlessness, Guilt, Isolation, Anxiety, Sorrow) have a strong positive link with clinical eco-anxiety. This study argues to make a distinction between a clinical approach to anxiety and the eco-emotions that anyone can feel, but it seems certain that there are overlaps. Indeed, qualitative studies on the subject (Ágoston, Csaba, et al., 2022a; Jalin, Chandès, et al., 2024; Kleres & Wettergren, 2017; Marczak, Winkowska, et al., 2023; Sapin et al., 2025) showed that eco-anxiety is experienced together with other emotions, or that emotions tend to blend together in what some have called “emotional flow”. In addition, it has been suggested in the manuscript that powerlessness or isolation can be considered as components of eco-anxiety in certain respects. We have chosen not to set expectations for hope/enthusiasm, as the relationship is unclear in our view, and to consider that the link between contempt (as anti-green emotion) and eco-anxiety is probably negative.

**Environmental awareness :** It is considered reasonable to expect that higher levels of environmental awareness are associated with higher levels of the various emotions reacting to the environmental situation (Ágoston, Csaba, et al., 2022b; Bamberg & Möser, 2007; Brosch, 2021; Hahnel & Brosch, 2018; Sapin et al., 2025; Van Valkengoed et al., 2021): anger, guilt, sadness, anxiety. Conversely, environmental awareness should be significantly and negatively linked to the contempt emotion. On the other hand, the links with powerlessness, isolation and hope/enthusiasm seem less clear. Regarding hope/enthusiasm, this caution is based on the fact that, with Ojala's dichotomy in mind (2012), we might expect to identify individuals with high hope/high awareness (constructive hope) but also high hope/low awareness (denial hope).

**Connectedness to nature :** The relationship with nature is intricately tied up with emotions, one of the most telling examples being

Albrecht's (2005, 2011) seminal work on psychoterratic illnesses. On both empirical and conceptual levels, several works (Clayton, 2020; Clayton & Karazsia, 2020; Galway et al., 2019; Jalin, Sapin, et al., 2024; Pihkala, 2020) thus support the idea that connectedness to nature plays a major role in several eco-emotions: anxiety, sorrow, guilt. It also seems relevant to consider a link between connectedness to nature and anger, but the literature is less clear on this point, so we would expect a positive and significant correlation, albeit weaker. In the absence of sufficient empirical work on the subject, we have also chosen not to set expectations concerning the link between connectedness to nature and hope, powerlessness and isolation.

**Behaviors :** As discussed in the manuscript, the literature (Ágoston, Urbán, et al., 2022; Caillaud et al., 2019; Marczak et al., 2024; Marczak, Wierzba, et al., 2023; Sampaio et al., 2023; Sapin et al., 2025; Stanley et al., 2021) suggest that several eco-emotions are positively associated with pro-environmental behaviours (both daily and political): anger, guilt, anxiety, sorrow, hope. In this vein, we'll assume that feelings of powerlessness act as a brake, as does contempt, which stands out as the only anti-green emotion measured. We have chosen not to formulate an expectation concerning isolation: it is an emotion less studied in the literature, and its link with the passage to action is, in our view, unclear.

**Political Orientation:** As mentioned in the manuscript, numerous studies and reviews (Banwell & Eggert, 2024; Kleres & Wettergren, 2017; Landmann, 2020; Pihkala, 2022; Sapin et al., 2025), have shed light on the resolutely moral nature of emotions. As such, we particularly expected anger to be associated with a more left-wing ideological and political orientation (and therefore a negative correlation with our ad hoc item) and, conversely, contempt to be associated with a more right-wing political orientation (and therefore a positive correlation). We also expect a negative correlation with anxiety, whose doubts characterize the attitude towards the ability of political actors to face environmental challenge. Although hope is an eminently political emotion, we have chosen not to make any predictions about it, as we consider our measure of political orientation to

be too simplistic to capture the subtlety of the links between different forms of hope (denial, constructive) and moral aspects.

**Appendix E.** Latent Profile Analysis : technical note regarding model computation and selection criteria

Regarding computation parametrization, LPA allows for several model structures, with or without equality constraints on the variances and covariances of the manifest variables between profiles. Here we report a model configured with equal variances and covariances between profiles, as more flexible models encountered estimation problems.

The choice of the solution was based primarily (Clark & Muthén, 2009; Tein et al., 2013) on the Bayesian Information Criterion (BIC), the entropy score, the average percentage of certainty of individuals regarding their assigned profile (with an 80% threshold) and avoiding to have profiles with under 5% of the total sample (Kamata et al., 2018). Another determining factor in the decision was the interpretability and conceptual value of the model.

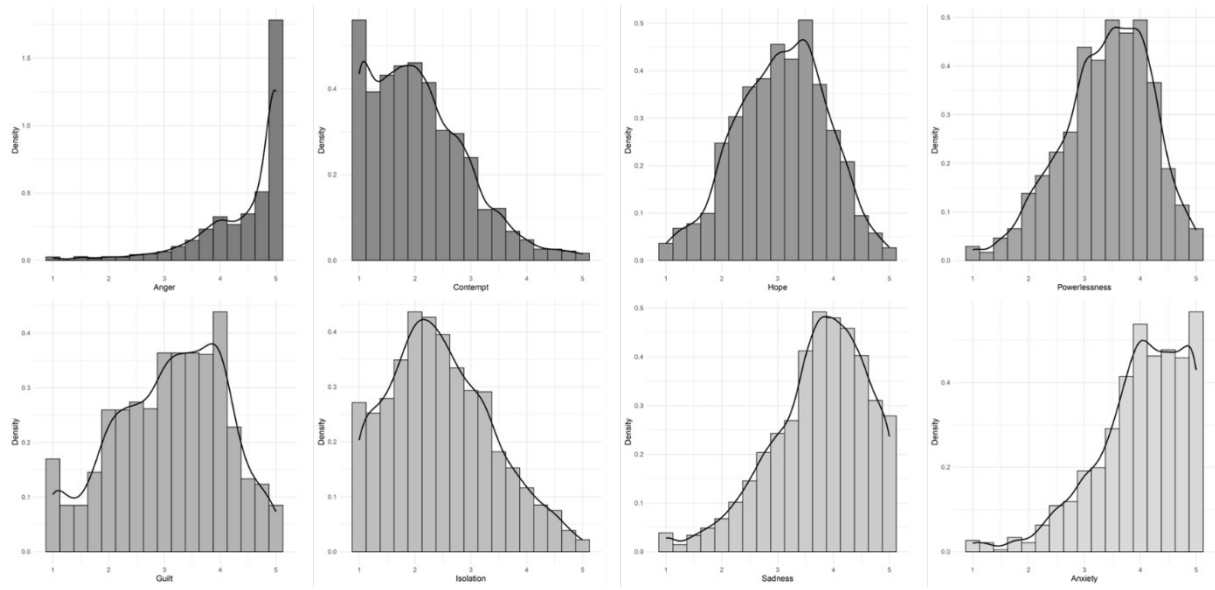
Model	Log-Likelihood	AIC	BIC	Entropy
1-profile solution	-14679	29447	29685	1
2-profiles solution	-14371	28848	29135	.943
3-profiles solution	-14298	28719	29054	.890
<b>4-profiles solution</b>	<b>-14249</b>	<b>28640</b>	<b>29024</b>	<b>.819</b>
5-profiles solution	-14206	28572	29005	.788
6-profiles solution	-14049	28275	28756	.708

The choice of solution was based on several indicators. The BIC decreased (and therefore improved) continuously as profiles are added, whereas entropy deteriorated and fell below the threshold of .80 from the fifth class onwards. The 5- and 6-profile solutions are therefore better adjusted according to the BIC, but they are also less good from an entropy perspective. We also relied on the uncertainty of profile assignment, which quantifies (in %) the probability of each participant being assigned to the different profiles. The usual threshold is that we aim the average certainty of the participants associated with each profile to be 80% or higher. Here, the 4-profile solution showed certainty in the target range (average



attribution percentage ranging from 81 to 92%, Appendix I-1), whereas the 5- and 6-profile solutions show less satisfactory percentages (Appendix J-2 and J-3). Also, the 6-profile solution show two profiles which are smaller than 5% of the total sample. The final decision criterion remained the interpretability of the results, and as such, the examination of the climate emotions scores of the different profiles for the different solutions with 4 (Table 7 in main manuscript) 3, 5, and 6 (Appendix J-1 to J-3) profiles led us to select the 4-profile solution, which was considered both clear to understand and conceptually rich.

## Appendix F. Graphical distribution of the ICE's subscores



**Appendix G.** Correlations between latent factors (emotions) in the ICE 8-factor AFC model

		Anger	Anxiety	Sorrow	Isolation	Guilt	Powerlessness	Hope/enthusiasm	Contempt
Anger	r	1.000							
	p	<.001							
Anxiety	r	.768 [.737,.800]	1.000						
	p	<.001	<.001						
Sorrow	r	.758 [.727,.789]	.831 [.804,.858]	1.000					
	p	<.001	<.001	<.001					
Isolation	r	.473 [.422,.523]	.600 [.560,.640]	.461 [.414,.508]	1.000				
	p	<.001	<.001	<.001	<.001				
Guilt	r	.490 [.444,.536]	.572 [.532,.611]	.566 [.526,.606]	.432 [.387,.478]	1.000			
	p	<.001	<.001	<.001	<.001	<.001			
Powerlessness	r	.191 [.128,.253]	.438 [.385,.491]	.297 [.240,.355]	.207 [.148,.266]	.546 [.501,.591]	1.000		
	p	<.001	<.001	<.001	<.001	<.001	<.001		
Hope/enthusiasm	r	.104 [.045,.163]	.090 [.034,.146]	.182 [.126,.238]	.022 [-.035,.079]	.162 [.110,.214]	-.207 [-.267,-.148]	1.000	
	p	<.001	.002	.000	.457	<.001	<.001	<.001	
Contempt	r	-.677 [-.717,-.637]	-.511 [-.556,-.465]	-.526 [-.571,-.481]	-.227 [-.282,-.173]	-.346 [-.394,-.297]	.072 [.011,.134]	-.125 [-.180,-.070]	1.000
	p	<.001	<.001	<.001	<.001	<.001	.021	<.001	<.001

**Appendix H.** Intergroup and longitudinal invariance analysis of the ICE (8-factor CFA)

Variable	CFI	TLI	RMSEA	SRMR	$\Delta$ CFI	$\Delta$ TLI	$\Delta$ RMSEA	$\Delta$ SRMR
Intergroup invariance								
<b>Gender<sup>1</sup></b>								
Configural	.945	.937	.054	.057				
Metric	.947	.941	.053	.060	+.002	+.004	-.002	+.003
Scalar	.943	.942	.052	.058	-.004	+.001	-.001	-.002
<b>Occupation</b>								
Configural	.946	.939	.054	.056				
Metric	.951	.946	.051	.057	+.005	+.007	-.003	+.001
Scalar	.949	.948	.050	.056	-.003	+.002	-.001	-.001
<b>Highest obtained diploma</b>								
Configural	.949	.942	.053	.059				
Metric	.956	.952	.048	.060	+.007	+.010	-.005	+.001
Scalar	.951	.952	.048	.059	-.005	+.001	.000	-.001
Longitudinal Invariance								
Configural	.94							
	1	.934	.041	.056				
Metric	.943	.937	.040	.057	+.002	+.003	-.001	+.001
Scalaire	.941	.939	.040	.057	-.002	+.002	.000	.000

*Notes : <sup>1</sup> Non-binary people were excluded from this analysis, as the group was too small. Also, the factor loading of the HOPE4 item had to be set manually (.95) in men to overcome estimation difficulties.*

**Appendix I.** Latent Profile Analysis: Additional information of the selected 4-profiles solution

**Table I-1.** Mean probabilities to be attributed in each profile for the 4-profiles solution

Mean probability to be attributed in the profile	<b>Normative aware</b> (N=1279, 77.5%)	<b>Climate angry</b> (N=101, 6.1%)	<b>Climate hostile</b> (N=138, 8.4%)	<b>Climate affected and active</b> (N=132, 8.0%)
% for Normative aware	<b>92%</b>	15%	7%	18%
% for Climate angry	2%	<b>84%</b>	0%	1%
% for Climate hostile	1%	0%	<b>92%</b>	0%
% for Climate affected and active	5%	1%	1%	<b>81%</b>

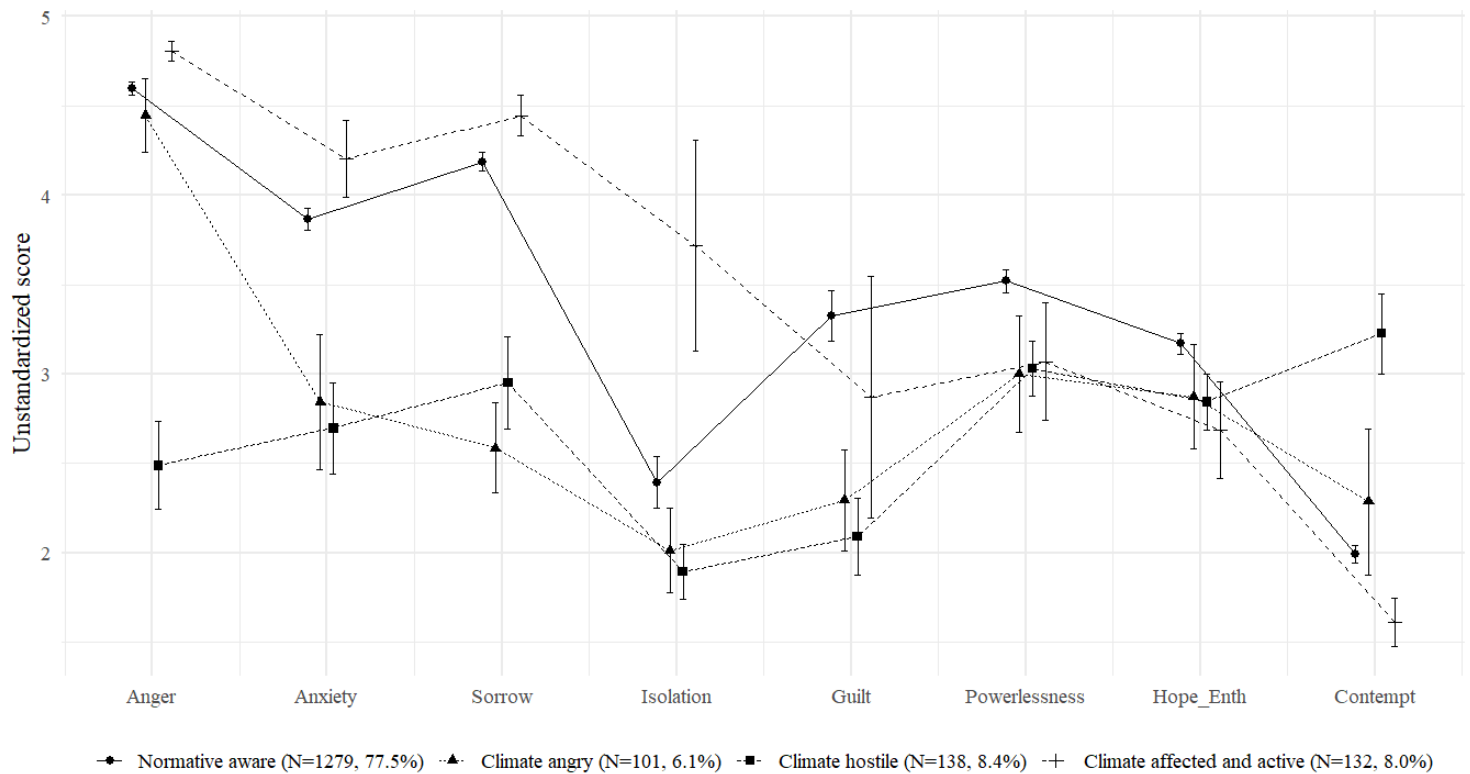
**Notes :** Having 80% or higher in each profile is a common threshold to considered the solution satisfactory

**Table I-2.** Unstandardized means of climate emotions according to the profiles

<b>Emotion</b>	<b>Normative aware</b> (N=1279, 77.5%)	<b>Climate angry</b> (N=101, 6.1%)	<b>Climate hostile</b> (N=138, 8.4%)	<b>Climate affected and active</b> (N=132, 8.0%)
	Mean [CI95%]	Mean [CI95%]	Mean [CI95%]	Mean [CI95%]
Anger	4.595 [4.556, 4.635]	4.443 [4.278, 4.608]	2.488 [2.267, 2.708]	4.805 [4.752, 4.857]
Anxiety	3.866 [3.799, 3.934]	2.843 [2.502, 3.185]	2.696 [2.500, 2.892]	4.205 [4.013, 4.396]
Sadness	4.187 [4.136, 4.239]	2.587 [2.387, 2.786]	2.952 [2.698, 3.205]	4.445 [4.330, 4.560]
Feeling_of_Isolation	2.394 [2.259, 2.530]	2.013 [1.772, 2.253]	1.895 [1.772, 2.017]	3.719 [3.174, 4.264]
Guilt	3.325 [3.198, 3.452]	2.296 [2.032, 2.560]	2.091 [1.903, 2.278]	2.873 [2.286, 3.460]
Powerlessness	3.521 [3.464, 3.578]	2.999 [2.703, 3.295]	3.031 [2.878, 3.183]	3.068 [2.762, 3.374]
Hope	3.170 [3.117, 3.222]	2.873 [2.636, 3.110]	2.844 [2.679, 3.009]	2.687 [2.415, 2.959]
Contempt	1.993 [1.947, 2.038]	2.286 [1.947, 2.625]	3.225 [3.033, 3.417]	1.614 [1.495, 1.733]

**Notes :** These estimates are directly extracted from the LPA, and therefore the estimates of each profile are weighted by the attribution probabilities of the individuals associated to this profile.

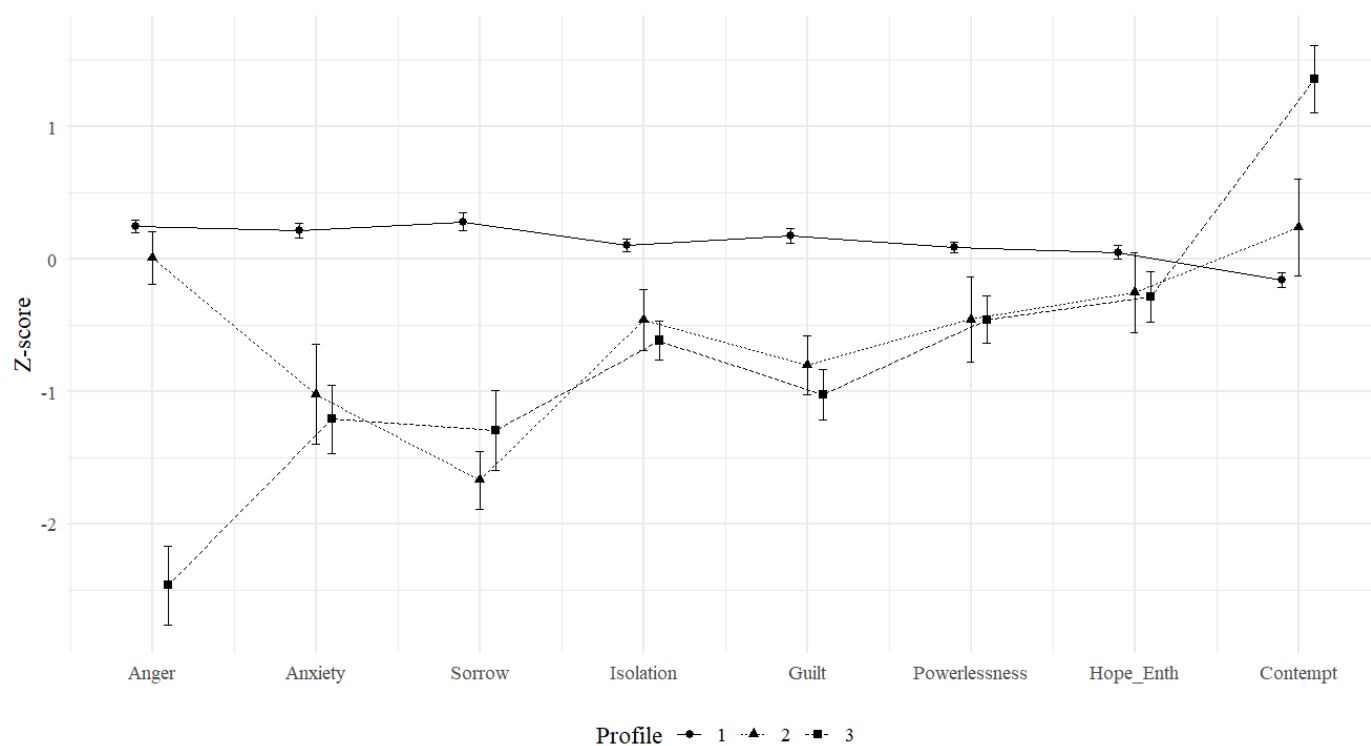
**Graph I-3.** Unstandardized means of climate emotions according to the profiles



## Appendix J. Latent Profile Analysis: Additional information on the non-selected models

### Appendix J-1. 3-profiles solution

**Graph J-1-1.** Z-score means of climate emotions according to the profiles (3-profiles solution)

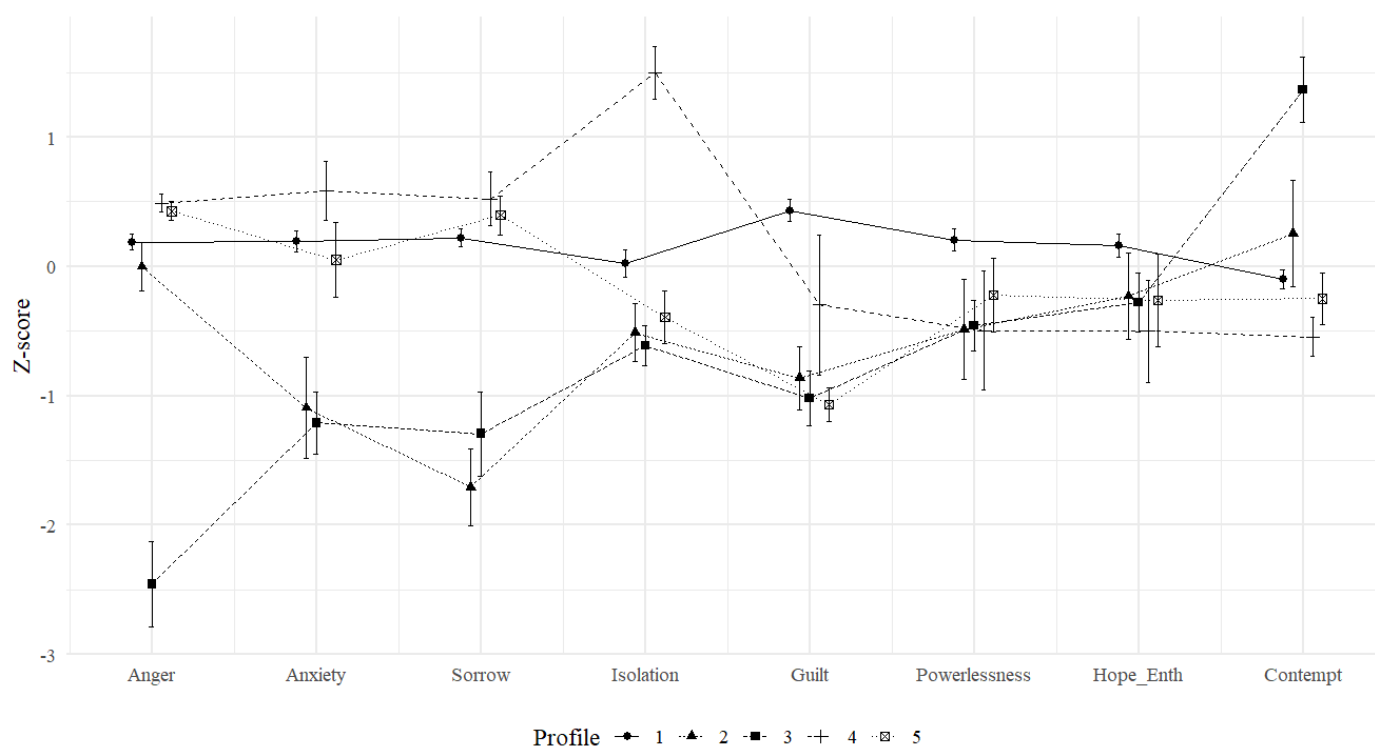


**Table J-1-2.** Mean probabilities to be attributed in each profile for the 3-profiles solution

Mean probability to be attributed in the profile	Profile 1 (N=1409, 85.4%)	Profile 2 (N=106, 6.4%)	Profile 3 (N=135, 8.2%)
% for Profile 1	<b>96%</b>	15%	7%
% for Profile 2	3%	<b>84%</b>	0%
% for Profile 3	1%	1%	<b>92%</b>

## Appendix J-2. 5-profiles solution

**Graph J-2-1.** Z-score means of climate emotions according to the profiles (5-profiles solution)



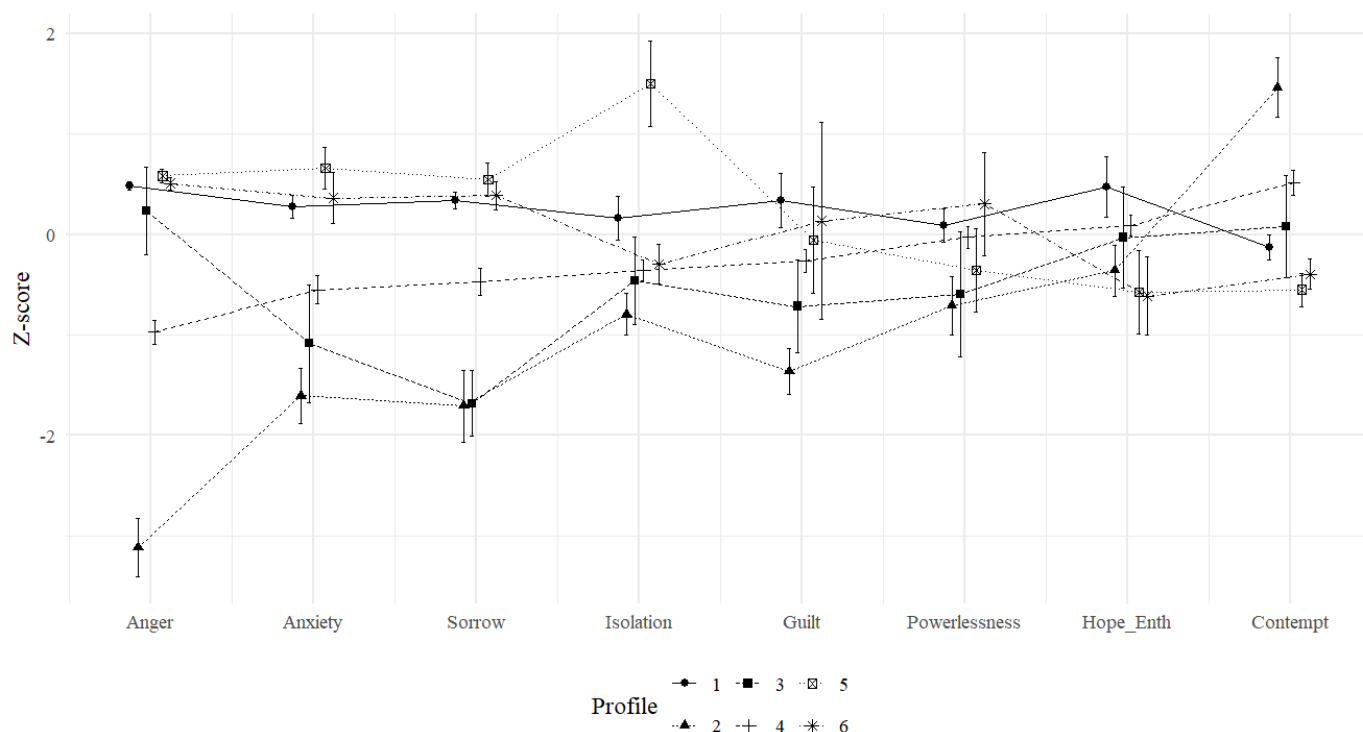
**Table J-2-2.** Mean probabilities to be attributed in each profile for the 5-profiles solution

Mean probability to be attributed in the profile	Profile 1 (N=1159, 7.2%)	Profile 2 (N=101, 6.2%)	Profile 3 (N=137, 8.3%)	Profile 4 (N=110, 6.7%)	Profile 5 (N=143, 8.6%)
% for Profile 1	<b>89%</b>	12%	7%	13%	14%
% for Profile 2	2%	<b>82%</b>	0%	1%	2%
% for Profile 3	1%	1%	<b>92%</b>	0%	0%
% for Profile 4	3%	1%	0%	<b>78%</b>	5%
% for Profile 5	5%	4%	1%	8%	<b>78%</b>



### Appendix J-3. 6-profiles solution

**Graph J-3-1.** Z-score means of climate emotions according to the profiles (6-profiles solution)



**Table J-3-2.** Mean probabilities to be attributed in each profile for the 6-profiles solution

Mean probability to be attributed in the profile	Profile 1 (N=684, 41.4%)	Profile 2 (N=76, 4.6%)	Profile 3 (N=68, 4.1%)	Profile 4 (N=369, 22.4%)	Profile 5 (N=134, 8.1%)	Profile 6 (N=319, 19.4%)
% for Profile 1	<b>74%</b>	0%	11%	4%	15%	24%
% for Profile 2	0%	<b>97%</b>	0%	1%	0%	0%
% for Profile 3	2%	0%	<b>78%</b>	1%	1%	1%
% for Profile 4	2%	3%	2%	<b>92%</b>	1%	2%
% for Profile 5	5%	0%	3%	1%	<b>76%</b>	4%
% for Profile 6	17%	0%	6%	2%	8%	<b>69%</b>

**Appendix K.** Multinomial logistic regression associating profiles and socio-demographic information

Predictors	% : profile vs reference	OR [CI95%]	p
<b>Profile 2 (“Climate Angry”) versus Reference profile (“Normative aware”)</b>			
Sex: Man vs Woman	53% vs 32%	2.21 [1.44 – 3.38]	<b>&lt;.001</b>
	22.39 (3.35) vs 22.25		
Age	(3.35)	1.09 [0.99 – 1.20]	.081
Occupation: Student vs Employed	77% vs 74%	1.49 [0.78 – 2.85]	.228
Highest obtained diploma: vs HS degree			
Bachelor’s degree	31 vs 28%	0.85 [0.48 – 1.50]	.568
Master’s degree	28 vs 33%	0.65 [0.31 – 1.34]	.241
Place of residence: vs Rural area			
Small city	16 vs 15%	2.16 [0.82 – 5.70]	.121
Medium city	22 vs 19%	2.18 [0.85 – 5.59]	.106
Large city	56 vs 52%	2.26 [0.94 – 5.41]	.067
Media exposure to climate information	6.63 (2.53) vs 7.30 (2.32)	0.89 [0.82 – 0.98]	<b>.014</b>
<b>Profile 3 (“Climate Hostile”) versus Reference profile (“Normative aware”)</b>			
Sex: Man vs Woman	71% vs 32%	4.99 [3.33 – 7.48]	<b>&lt;.001</b>
	21.57 (3.56) vs 22.25		
Age	(3.35)	1.00 [0.91 – 1.10]	.970
Occupation: Student vs Employed	71% vs 74%	1.84 [0.99 – 3.43]	.055
Highest obtained diploma: vs HS degree			
Bachelor’s degree	27 vs 28%	0.86 [0.51 – 1.45]	.565
Master’s degree	25 vs 33%	1.19 [0.61 – 2.29]	.612
Place of residence: vs Rural area			
Small city	25 vs 15%	1.09 [0.60 – 2.00]	.769
Medium city	18 vs 19%	0.67 [0.36 – 1.27]	.223
Large city	38 vs 52%	0.54 [0.31 – 0.94]	<b>.028</b>
Media exposure to climate information	5.75 (2.23) vs 7.30 (2.32)	0.80 [0.74 – 0.86]	<b>&lt;.001</b>
<b>Profile 4 (“Climate affected and active”) versus Reference profile (“Normative aware”)</b>			
Sex: Man vs Woman	54% vs 32%	2.48 [1.68 – 3.66]	<b>&lt;.001</b>
	23.44 (3.61) vs 22.25		
Age	(3.35)	1.11 [1.02 – 1.21]	<b>.021</b>
Occupation: Student vs Employed	71% vs 74%	0.91 [0.53 – 1.57]	.743
Highest obtained diploma: vs HS degree			
Bachelor’s degree	33 vs 28%	1.03 [0.60 – 1.79]	.903
Master’s degree	39 vs 33%	0.74 [0.38 – 1.44]	.376
Place of residence: vs Rural area			
Small city	10 vs 15%	0.65 [0.29 – 1.45]	.296
Medium city	18 vs 19%	0.89 [0.44 – 1.80]	.749
Large city	59 vs 52%	0.98 [0.54 – 1.79]	.946

Media exposure to climate information	7.71 (2.48) vs 7.30 (2.32)	1.09 [1.00 - 1.20]	.060
---------------------------------------	----------------------------	--------------------	------

*Notes : 151 Individuals from very small categories (Sex: Non-binary and Occupation: Other) were excluded from this analysis for estimation purposes (some profile\*categories were represented by less than 10 individuals). Therefore, this regression is conducted with 1499 respondents.*

## REFERENCES USED IN THE SUPPLEMENTARY

- Ágoston, C., Csaba, B., Nagy, B., Kőváry, Z., Dúll, A., Rácz, J., & Demetrovics, Z. (2022a). Identifying Types of Eco-Anxiety, Eco-Guilt, Eco-Grief, and Eco-Coping in a Climate-Sensitive Population : A Qualitative Study. *International Journal of Environmental Research and Public Health*, 19(4), Article 4.  
<https://doi.org/1.3390/ijerph19042461>
- Ágoston, C., Csaba, B., Nagy, B., Kőváry, Z., Dúll, A., Rácz, J., & Demetrovics, Z. (2022b). Identifying Types of Eco-Anxiety, Eco-Guilt, Eco-Grief, and Eco-Coping in a Climate-Sensitive Population : A Qualitative Study. *International Journal of Environmental Research and Public Health*, 19(4), Article 4.  
<https://doi.org/1.3390/ijerph19042461>
- Ágoston, C., Urbán, R., Nagy, B., Csaba, B., Kőváry, Z., Kovács, K., Varga, A., Dúll, A., Mónus, F., Shaw, C. A., & Demetrovics, Z. (2022). The psychological consequences of the ecological crisis : Three new questionnaires to assess eco-anxiety, eco-guilt, and ecological grief. *Climate Risk Management*, 37, 100441.  
<https://doi.org/1.1016/j.crm.2022.100441>

- Albrecht, G. (2005). « Solastalgia ». A New Concept in Health and Identity. *PAN: Philosophy Activism Nature*.  
<https://search.informit.org/doi/abs/1.3316/informit.897723015186456>
- Albrecht, G. (2011). Chronic Environmental Change : Emerging 'Psychoterratic' Syndromes. In I. Weissbecker (Éd.), *Climate Change and Human Well-Being* (p. 43-56). Springer New York.  
[https://doi.org/1.1007/978-1-4419-9742-5\\_3](https://doi.org/1.1007/978-1-4419-9742-5_3)
- Alisat, S., & Riemer, M. (2015). The environmental action scale : Development and psychometric evaluation. *Journal of Environmental Psychology*, 43, 13-23.  
<https://doi.org/1.1016/j.jenvp.2015.05.006>
- Bamberg, S., & Möser, G. (2007). Twenty years after Hines, Hungerford, and Tomera : A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *Journal of Environmental Psychology*, 27(1), 14-25. <https://doi.org/1.1016/j.jenvp.2006.12.002>
- Banwell, N., & Eggert, N. (2024). Rethinking ecoanxiety through environmental moral distress : An ethics reflection. *The Journal of Climate Change and Health*, 15, 100283.  
<https://doi.org/1.1016/j.joclim.2023.100283>
- Beaujean, A. A. (2014). Models with Dichotomous Indicator Variables. In *Latent Variable Modeling Using R*. Routledge.
- Brick, C., Sherman, D. K., & Kim, H. S. (2017). "Green to be seen" and "brown to keep down" : Visibility moderates the effect of identity on

- pro-environmental behavior. *Journal of Environmental Psychology*, 51, 226-238. <https://doi.org/1.1016/j.jenvp.2017.04.004>
- Brosch, T. (2021). Affect and emotions as drivers of climate change perception and action : A review. *Current Opinion in Behavioral Sciences*, 42, 15-21. <https://doi.org/1.1016/j.cobeha.2021.02.001>
- Brown, T. A. (2006). *Confirmatory factor analysis for applied research* (p. xiii, 475). The Guilford Press.
- Cai, L., & Moustaki, I. (2018). Estimation Methods in Latent Variable Models for Categorical Outcome Variables. In *The Wiley Handbook of Psychometric Testing* (p. 253-277). John Wiley & Sons, Ltd. <https://doi.org/1.1002/9781118489772.ch9>
- Caillaud, S., Krauth-Gruber, S., & Bonnot, V. (2019). Facing Climate Change in France and Germany : Different Emotions Predicting the Same Behavioral Intentions? *Ecopsychology*, 11(1), 49-58. <https://doi.org/1.1089/eco.2018.0060>
- Chen, F. F. (2007). Sensitivity of Goodness of Fit Indexes to Lack of Measurement Invariance. *Structural Equation Modeling: A Multidisciplinary Journal*, 14(3), 464-504. <https://doi.org/1.1080/10705510701301834>
- Clark, S., & Muthén, B. (2009). *Relating Latent Class Analysis Results to Variables not Included in the Analysis*.
- Clayton, S. (2020). Climate anxiety : Psychological responses to climate change. *Journal of Anxiety Disorders*, 74, 102263. <https://doi.org/1.1016/j.janxdis.202.102263>

- Clayton, S., & Karazsia, B. T. (2020). Development and validation of a measure of climate change anxiety. *Journal of Environmental Psychology, 69*, 101434. <https://doi.org/10.1016/j.jenvp.2020.101434>
- Galway, L. P., Beery, T., Jones-Casey, K., & Tasala, K. (2019). Mapping the Solastalgia Literature : A Scoping Review Study. *International Journal of Environmental Research and Public Health, 16*(15), Article 15. <https://doi.org/10.3390/ijerph16152662>
- Hahnel, U. J. J., & Brosch, T. (2018). Environmental trait affect. *Journal of Environmental Psychology, 59*, 94-106. <https://doi.org/10.1016/j.jenvp.2018.08.015>
- Hair, J. F., Black, W., Anderson, R., & Babin, B. (2019). *Multivariate data analysis* (Eighth edition). Cengage.
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis : Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*(1), 1-55. <https://doi.org/10.1080/10705519909540118>
- Jalin, H., Chandes, C., Congard, A., & Boudoukha, A.-H. (2024). Appréhender l'éco-anxiété : Une approche clinique et phénoménologique. *Psychologie Française, 69*, S0033298422000255. <https://doi.org/10.1016/j.psfr.2022.03.003>
- Jalin, H., Sapin, A., Macherey, A., Boudoukha, A. H., & Congard, A. (2024). Understanding eco-anxiety : Exploring relationships with environmental trait affects, connectedness to nature, depression, anxiety, and media exposure. *Current Psychology*. <https://doi.org/10.1007/s12144-024-06098-y>

- Kamata, A., Kara, Y., Patarapichayatham, C., & Lan, P. (2018). Evaluation of Analysis Approaches for Latent Class Analysis with Auxiliary Linear Growth Model. *Frontiers in Psychology, 9*.  
<https://doi.org/10.3389/fpsyg.2018.00130>
- Kleres, J., & Wettergren, Å. (2017). Fear, hope, anger, and guilt in climate activism. *Social Movement Studies, 16*(5), 507-519.  
<https://doi.org/10.1080/14742837.2017.1344546>
- Kline, R. B. (2011). *Principles and practice of structural equation modeling, 3rd ed* (p. xvi, 427). Guilford Press.
- Landmann, H. (2020). Emotions in the context of environmental protection : Theoretical considerations concerning emotion types, eliciting processes, and affect generalization. In *Umweltpsychologie* (Vol. 24, Numéro 2, p. 61-73). <https://doi.org/10.31234/osf.io/yb2a7>
- Marczak, M., Wierzba, M., Kossowski, B., Marchewka, A., Morote, R., & Klöckner, C. A. (2024). Emotional responses to climate change in Norway and Ireland : A validation of the Inventory of Climate Emotions (ICE) in two European countries and an inspection of its nomological span. *Frontiers in Psychology, 15*.  
<https://doi.org/10.3389/fpsyg.2024.1211272>
- Marczak, M., Wierzba, M., Zaremba, D., Kulesza, M., Szczypiński, J., Kossowski, B., Budziszewska, M., Michałowski, J. M., Klöckner, C. A., & Marchewka, A. (2023). Beyond climate anxiety : Development and validation of the inventory of climate emotions (ICE): A measure of multiple emotions experienced in relation to climate

- change. *Global Environmental Change*, 83, 102764.  
<https://doi.org/1.1016/j.gloenvcha.2023.102764>
- Marczak, M., Winkowska, M., Chaton-Østlie, K., Morote Rios, R., & Klöckner, C. A. (2023). “When I say I’m depressed, it’s like anger.” An exploration of the emotional landscape of climate change concern in Norway and its psychological, social and political implications. *Emotion, Space and Society*, 46, 100939.  
<https://doi.org/1.1016/j.emospa.2023.100939>
- Markle, G. L. (2013). Pro-Environmental Behavior : Does It Matter How It’s Measured? Development and Validation of the Pro-Environmental Behavior Scale (PEBS). *Human Ecology*, 41(6), 905-914. <https://doi.org/1.1007/s10745-013-9614-8>
- Mouguiama-Daouda, C., Blanchard, M. A., Coussement, C., & Heeren, A. (2022). On the Measurement of Climate Change Anxiety : French Validation of the Climate Anxiety Scale. *Psychologica Belgica*, 62(1), Article 1. <https://doi.org/1.5334/pb.1137>
- Ojala, M. (2012). Hope and climate change : The importance of hope for environmental engagement among young people. *Environmental Education Research*, 18(5), 625-642.  
<https://doi.org/1.1080/13504622.2011.637157>
- Pihkala, P. (2020). Anxiety and the Ecological Crisis : An Analysis of Eco-Anxiety and Climate Anxiety. *Sustainability*, 12(19), Article 19.  
<https://doi.org/1.3390/su12197836>



- Pihkala, P. (2022). Toward a Taxonomy of Climate Emotions. *Frontiers in Climate, 3*.  
<https://www.frontiersin.org/articles/1.3389/fclim.2021.738154>
- Putnick, D. L., & Bornstein, M. H. (2016). Measurement Invariance Conventions and Reporting : The State of the Art and Future Directions for Psychological Research. *Developmental review : DR, 41*, 71-9. <https://doi.org/10.1016/j.dr.2016.06.004>
- Sampaio, F., Costa, T., Teixeira-Santos, L., de Pinho, L. G., Sequeira, C., Luís, S., Loureiro, A., Soro, J. C., Roldán Merino, J., Moreno Poyato, A., Peña Loray, J. S., Rodríguez Quiroga, A., O'Brien, L. V., Hogg, T. L., & Stanley, S. K. (2023). Validating a measure for eco-anxiety in Portuguese young adults and exploring its associations with environmental action. *BMC Public Health, 23*(1), 1905.  
<https://doi.org/10.1186/s12889-023-16816-z>
- Sapin, A., Anais, A., Clayton, S., Bujard, V., Jalin, H., & Fleury-Bahi, G. (2025). *"With all these feelings, I just can't stay passive": An exploration of eco-emotions, political attitude, perceived injustice and pro-environmental behaviors among young adults in France*. OSF. [https://doi.org/10.31234/osf.io/h7f4r\\_v1](https://doi.org/10.31234/osf.io/h7f4r_v1)
- Stanley, S. K., Hogg, T. L., 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>

Tein, J.-Y., Coxe, S., & Cham, H. (2013). Statistical Power to Detect the Correct Number of Classes in Latent Profile Analysis. *Structural Equation Modeling: A Multidisciplinary Journal*, 20(4), 640-657.

<https://doi.org/10.1080/10705511.2013.824781>

Van Valkengoed, A. M., Steg, L., & Perlaviciute, G. (2021). Development and validation of a climate change perceptions scale. *Journal of Environmental Psychology*, 76, 101652.

<https://doi.org/10.1016/j.jenvp.2021.101652>