Research Articles

A New Planetary Affective Science Framework for Eco-Emotions: Findings on Eco-Anger, Eco-Grief, and Eco-Anxiety

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Abstract

Emotions play a critical role in human health and behavior yet have largely been overlooked in the context of the global environmental crisis (GEC). Despite recent emphasis on climate anxiety and eco-anxiety, there is a lack of psychometric or dimensional measures assessing the fuller range of GEC-associated emotions, especially beyond Western, educated, industrialized, rich, and democratic (WEIRD) contexts. Further conceptual gaps hinder structured inquiry and generalizability. This exploratory study applies a new planetary affective science framework to holistically and systematically address these issues. We used a circumplex model to map core affect and structured interviews with 15 Turkish environmentalists to explore the range of eco-emotions. Our findings suggest the prevalence of eco-anger and eco-grief over the eco-anxiety most often assessed in WEIRD contexts. Similar findings in post-disaster situations underscore participants' heightened vulnerability to cumulative stressors and the dangers of emotion-specific omissions (e.g., anger) in assessment tools. We identified environmental justice, developing country tension, self-efficacy dimensions, and responsibility attributions to the Turkish government and Global North as key contextual factors in these differentiated eco-emotional patterns. Findings constitute

the first step toward more holistic, diverse, and conceptually rigorous eco-emotions research, urgently needed for more effective pro-environmental health and behavioral interventions amidst the intensifying GEC.

Keywords

eco-emotions, affect, climate change, planetary boundaries, environmental justice

Özet

Duygular, insan sağlığı ve davranışında kritik bir rol oynamasına rağmen, küresel çevre krizi ve iklim değişikliği (KÇKID) bağlamında büyük ölçüde göz ardı edilmiştir. Son zamanlarda ekolojik kaygıya daha fazla vurgu yapılsa da, özellikle Batılı, Eğitimli, Sanayileşmiş, Zengin ve Demokratik ("WEIRD") bölgelerin ötesinde, KÇKID ile ilişkili duyguları daha kapsamlı şekilde değerlendiren psikometrik ölçüm araçlarına ilişkin bir eksiklik bulunmaktadır. Buna ek olarak, literatürdeki kavramsal boşluklar kapsamlı inceleme ve genelleştirilebilirliğin önünde engel teşkil etmektedir. Bu keşfedici çalışma, bahsi geçen bu sorunları bütünsel ve sistematik şekilde ele almak için yeni bir duygubilimsel bir çerçeve uygulamaktadır. Çekirdek duygulanımı haritalamak için çembersel bir model kullanılmış ve eko-duyguları keşfetmek için 15 Türk çevreciyle yapılandırılmış görüşmeler yapılmış ve toplamda 56 duygu belirlenmiştir. Bulgularımız, "WEIRD" örneklemlerde sıkça görülen ekolojik kaygının aksine ekolojik öfke ve ekolojik yasın yaygınlığına işaret etmektedir. Afet sonrası durumlardaki benzer bulgular, katılımcıların kümülatif stres faktörlerine karşı artan savunmasızlığının ve değerlendirme araçlarındaki duyguya özgü eksikliklerin oluşturduğu risklerin altını çizmektedir. Çevresel adalet, gelişmekte olan ülke gerilimi ve öz yeterlilik boyutları ile Türk hükümetine ve Küresel Kuzey'e yapılan sorumluluk atıfları, bu farklılaşmış eko-duygusal örüntülerde temel bağlamsal faktörler olarak tanımlanmıştır. Bulgular, etkisini arttıran KÇKID'in ortasında etkili çevre dostu davranışsal müdahaleler için acilen ihtiyaç duyulan daha bütüncül, çeşitli ve kavramsal olarak özenli eko-duygular araştırmasına yönelik ilk adımı oluşturmaktadır.

Anahtar kelimeler

eko-duygular, duygulanım, iklim değişikliği, gezegensel sınırlar, çevresel adalet

Non-Technical Summary

Background

The global environmental crisis (GEC) has a significant negative impact on human wellbeing. Specific emotions play an important role in our physical and mental health—e.g., anger increases the risk of cardiovascular disease—and environmentally friendly mitigation and adaptation behaviors. However, specific emotions as they relate to the environment have been understudied until recently. Despite increasing attention paid to 'climate anxiety' or 'eco-anxiety' in academic and media circles, there are currently no psychometrically validated measures for the full range of 'eco-emotions'. Additionally, most studies have been con-

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ducted in Western, educated, industrialized, rich, and democratic (WEIRD) countries, despite the GEC having more negative effects in underprivileged and poor areas. As a result, we still lack (1) a comprehensive understanding of the most common eco-emotions, especially in underprivileged contexts, and (2) validated assessment tools based on this understanding, which are necessary to improve emotion-specific human health and behavioral outcomes.

Why was this study done?

Our goal was to gain an understanding of the complete spectrum of eco-emotions in an understudied and underprivileged population who are facing cumulative stressors such as exposure to environmental degradation, health risks, disasters, and trauma. We aimed to create a comprehensive list of specific emotions that we could include for future psychometric validation by mapping these eco-emotions in an organic 'bottom-up' way. Further, we found there was a lack of theoretical frameworks for discussing eco-emotions holistically, including both positive and negative emotions, and for structuring them systematically based on current knowledge in emotion science, a.k.a. affective psychology.

What did the researchers do and find?

To address these two theoretical issues mentioned earlier, we introduced a new theoretical framework that defines eco-emotions as emotions about the environment and environmental issues based on the planetary boundaries (PB) concept. This approach allowed us to capture both positive and negative eco-emotions under a single umbrella term. Additionally, we applied a state-of-the-art theoretical approach from affective psychology. We termed these two frameworks together as our 'planetary affective science' framework. To identify a list of eco-emotions for future psychometric validation, we analyzed core affect and emotion data from structured interviews with 15 Turkish environmentalists. Our analysis identified a list of 56 eco-emotions, both positive and negative, that participants reported experiencing. Surprisingly, we found that eco-anger and eco-grief were the most common eco-emotions, rather than the expected eco-anxiety based on the current WEIRD-skewed research. Participants experienced feelings of eco-grief and eco-anger after they had time to process direct experiences of environmental disasters, such as wildfires and pollution. We also found that factors such as environmental justice, Türkiye's developing country status, and self-efficacy, and participants' blaming of the Turkish government and Global North for current environmental conditions, were important factors shaping their eco-emotions.

What do these findings mean?

Our mapping of the diverse range of eco-emotions revealed that many of these emotions are yet to be included in general and psychometrically validated measures. We found that anger, in particular, is a major omission in eco-emotions research, as well as in post-traumatic response assessments to disaster events. Since specific emotions play a critical role in specific health and behavioral outcomes, more holistic, regionally representative, and scientifically rigorous assessment tools are urgently needed to address this gap.

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> **Highlights**
> - New conceptual framework introduced for eco-emotions built on the nine planetary boundaries.
> - Structured interviews with 15 Turkish participants engaged in environmental work.
> - Application of state-of-the-art affective science framework revealed eco-anger and eco-grief as most prominent eco-emotions.
> - Eco-emotions shaped by environmental justice, Global North responsibility attribution, self-efficacy, country development, and Turkish governmental responsibility.
> - Individual pro-environmental behavior, avoidance, and distraction most commonly reported emotion regulation and coping strategies, possibly due to political barriers on collective behaviors (e.g., protesting).

Context

The human health impacts of the intensifying global environmental crisis (GEC) are rapidly increasing (IPCC, 2022), with the critical 1.5° C warming threshold now expected to be crossed as early as 2033–2035 (Diffenbaugh & Barnes, 2023). Climate change causes 150,000 excess deaths per year, with a projected increase of up to 250,000 annually between 2030–2050 (WHO, 2021). Research to date has focused on physical health impacts (Berry et al., 2018), but the GEC also poses serious risks to psychological health (WHO, 2021)—especially to communities and countries disproportionately affected due to the "uneven distribution of physical climate change hazards, exposure or vulnerability" (IPCC, 2022, p. 18), and to people with pre-existing mental health conditions. Further compounding these risks, stress sensitization and cumulative trauma exposure effects have been observed in those experiencing more than one natural or anthropogenic disaster-related trauma, such as wildfires, and/or interpersonal-related trauma, such as violent conflict (Goenjian et al., 2022).

A strong association exists between psychological and physical health risks (Ohrnberger et al., 2017), with emotions now recognized to play a critical role in this link (Levenson, 2019). Thus, emotions are increasingly being integrated into psychosomatic medicine models, but often still as broad categories (e.g., 'negative emotions'), despite the differentiated health outcomes of specific negative emotions (e.g., anger increasing the risk of cardiovascular disease) (Levenson, 2019). The field of psychology, too, is experiencing an 'affective revolution' wherein the key role of affective processes is increasingly recognized in behavioral, cognitive, motivational, mental health, and well-being models (Dukes et al., 2021). This affective shift is important considering the centrality of these processes in climate change mitigation and adaptation behaviors and other pro-environmental interventions (Brosch, 2021). Consequently, given the recency

of these ongoing developments, the underlying emotional dimension of the GEC has been largely overlooked to date.

Affect is generally considered the broadest and most inclusive psychological construct encompassing core affect, emotions, and moods—terms often used interchangeably, but inaccurately (Ekkekakis, 2013). Research exploring GEC-associated emotions describes a preliminary taxonomy of 'climate emotions,' overwhelmingly negative, with the 11 umbrella categories of surprise, threat, sadness, strong anxiety, strong depression, guilt/shame, anger, indignation, disgust, hostility, and positive emotions (Pihkala, 2022). Most of this research, and accompanying media and public attention (Yoder, 2021), focuses on anxiety, often termed 'climate anxiety' or 'eco-anxiety' and defined by the American Psychological Association (APA) as "chronic fear of environmental doom" (Clayton et al., 2017, p. 68). 'Solastalgia' or chronic distress from environmental change (Albrecht, 2019, p. 11), climate change worry, and climate/ecological grief are also emphasized (Cunsolo Willox et al., 2013; Ojala et al., 2021). While many studies in this area include some discrete emotion measures, most are not psychometrically validated. Those that are, parallel the depression, anxiety, and stress scale (DASS) used in clinical mental health settings. At the broader scope, a wealth of studies examine the GEC's mental health impacts. However, emotions are a crucial, but not the only, component of the complex continuum that comprises mental health and wellbeing (WHO, 2022a). Given this important distinction, existing measures may not be representative of the full range of GEC-associated emotions, highlighting the urgent need for more holistic affective assessment tools.

Research Gaps

The lack of psychometrically validated discrete emotion measures and the lack of application of dimensional emotion measures for assessing the fuller range of GEC-associated emotions is a substantial research gap.[1] Among others, anger is a "major omission" in the literature (Pihkala, 2022, p. 15), despite the finding that frustration, a component of eco-anger, was the most frequently experienced climate emotion in a representative Australian sample (Stanley et al., 2021). In a 10-country youth sample, differentiated from adult samples by well-established age differences in emotional experience and regulation (Gross et al., 1997), 57% of respondents felt angry about climate change, with the top three countries being from the Global South (Hickman et al., 2021). A qualitative study about climate activists from the Global North versus South also found higher prevalence of anger in the latter group, who attributed guilt and responsibility to northern countries (Kleres & Wettergren, 2017). Similarly, many COP26 participants from the Global South expressed anger, grief, sadness, and futility following the event (Sultana, 2022, p. 2).

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1) The preprint of a new scale, validated in a Polish sample, that addresses numerous of these issues is available at Marczak et al. (2022).

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A 32-country study, which excluded anger from its measure, found climate anxiety more strongly associated with pro-environmental behavior in higher-income countries, possibly due to significant collective action barriers faced by Global South populations (Ogunbode et al., 2022).

These findings point to another major research gap: studies to date, especially the limited number of psychometrically validated ones, have focused on Western, educated, industrialized, rich, and democratic (WEIRD) country populations, despite the GEC having a disproportionately larger impact on underprivileged communities and countries (IPCC, 2022). Scale development and psychometric validation took place in Australia for the Environmental Distress Scale (Higginbotham et al., 2006), in Australia and New Zealand for the Hogg Eco-Anxiety Scale (Hogg et al., 2021), and in a largely White American sample for the Climate Anxiety Scale (Clayton & Karazsia, 2020). This narrow focus reflects the larger generalizability issue within the WEIRD-skewed field of environmental psychology (Aruta, 2023; Tam & Milfont, 2020), further challenged by well-established cultural differences in emotion expression and regulation between Western, independent, individualistic versus Eastern, interdependent, collectivist cultures (Tsai et al., 2006). Construct labeling also matters; linguistic variation—e.g., grief is more similar to regret in Persian but to anxiety in Dargwa (Jackson et al., 2019)—and even wording choice within unilingual measures—e.g., 'climate change' versus 'global warming' (Schuldt et al., 2017)—may lead to different results. Climate emotions versus eco-emotions, too, are sometimes conflated ('Planetary Eco-Emotions Framework' section). Positive emotions have also been underexplored (Pihkala, 2022)—especially their potentially protective effect against maladaptive emotional responses to the GEC (Westoby et al., 2022)—despite their important albeit nuanced role in environmental decision-making and collective action (Schneider et al., 2021).

These gaps highlight the need for greater transparency related to implicit assumptions and concept operationalization across studies; this transparency is necessary for future inquiry into these 'known' and 'known unknown' eco-emotional differences across WEIRD and non-WEIRD contexts. We posit that the four-dimensional construct of psychological distance—humans respond differently when they perceive an object/event to be psychologically close or far away (Maiella et al., 2020)—may help explain observed and hypothesized differences. First, regarding spatial distance, in studies conducted primarily with WEIRD populations, people tend to perceive climate change as worse in developing areas and occurring remotely (Gifford et al., 2009; Reser et al., 2012). Second, regarding temporal distance, while WEIRD populations may have more recently experienced direct impacts, they may consider its more severe impacts far in the future (Leiserowitz, 2005). Indeed, according to the World Health Organization (WHO) international classification of diseases (ICD-11), "anxiety is more future-oriented, referring to perceived anticipated threat" (WHO, 2022b). Third, regarding hypothetical distance, this privilege of being future-oriented simply is not afforded to non-WEIRD populations, who

are already disproportionately affected by the GEC (IPCC, 2022), with consequently less uncertainty and hypothetical distance to an already directly lived experience. Fourth, regarding social distance, personal proximity to an event is related to greater concern (Maiella et al., 2020); we would thus expect to observe more negatively valenced and/or higher activation eco-emotional patterns in non-WEIRD contexts. Overall, we hypothesize the most commonly experienced negative eco-emotions may differ altogether from the anxiety patterns observed through existing psychometric measures.
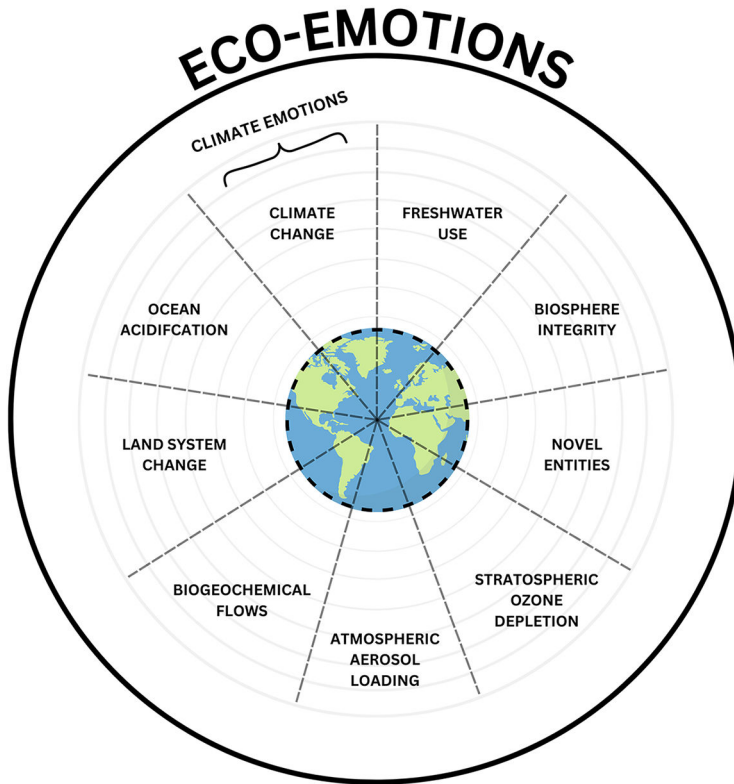
Planetary Eco-Emotions Framework

Climate emotions and eco-emotions are terms and constructs sometimes used interchangeably; however, they can be meaningfully differentiated in the specific object of their eliciting stimulus. This elicitation process is part of what differentiates emotions from other affective phenomena such as core affect and moods ('Affective Science Framework' section) (Ekkekakis, 2013). Emerging in the 1980–90s, the term 'eco-emotions' refers to emotions related to ecological issues (Pihkala, 2022). Climate change subsequently became the focus of eco-emotions research, leading to the emergence of 'climate emotions' (Pihkala, 2022), meaning emotions related to the climate crisis. Based on this precedent, 'eco-emotions' is the broader category; philosopher Albrecht (2019) similarly defines 'Earth emotions' as emotional responses "to the scale and pace of ecological and environmental change" (Albrecht, 2019, p. ix). However, all these constructs are still problem-centered, despite nature being both the trigger for and answer to eco-grief, eco-anger, and eco-anxiety (Westoby et al., 2022). Thus, the psychological field needs an operationalizable umbrella construct able to more fully account for the range and dimensionality of emotions, both positive and negative, that are significantly related to the environment.

We therefore advance a new conceptual framework for eco-emotions that reflects the complex and interconnected nature of the GEC in the 21st century. We interpret eco-emotions through a planetary perspective, holistically encompassing the full range of emotions about the overall environment including nature as well as the anthropogenic changes happening in the environment (Figure 1).

Figure 1

Proposed Planetary Framework for Eco-Emotions

Note. The proposed planetary framework for eco-emotions encompasses emotions about the environment as well as environmental issues conceptualized as the planetary boundaries (PBs), with climate emotions being specific to the PB of climate change. The PBs concept is based on Rockström et al. (2009); due to ongoing quantification, the state of each PB has been omitted. This figure instead aims to holistically showcase the fuller range of environmental issues. For the latest PBs quantification, see Richardson et al. (2023).

These anthropogenic changes, or environmental issues, are interpreted to consist of the nine planetary boundaries (PBs) that define the environmental limits for humanity's safe operation: climate change, biodiversity loss, ocean acidification, freshwater change, land system change, chemical pollution, stratospheric ozone depletion, biogeochemical flows in the nitrogen and phosphorus cycles, and atmospheric aerosol loading (Steffen et al., 2015). Our use of the GEC term and this planetary eco-emotions framework recognizes the multidimensional yet interconnected nature of these PBs that are characterized by cross-scale interactions and compounding effects and in which climate change is perhaps the most significant, but not the only, ongoing crisis occuring in the environment.

In contrast to the climate-specificity of climate emotions, we believe this planetary framework enables: (1) more holistic and systematic mapping of the full potential range of positive and negative eco-emotions; and (2) somewhat counterintuitively, better accounting for regional variability and context-specific nuances. Environmental issues vary in patterns and intensity and may thus be experienced more directly across regions: e.g., an Ethiopian study found high activation/arousal negative (HAN) emotions associated specifically with freshwater scarcity (PB: freshwater change) (Cooper et al., 2019). Further, those with high levels of nature-connectedness may have the most HAN emotional responses to the ongoing sixth mass extinction (PB: biosphere integrity).

Affective Science Framework

Despite psychology's recent affective turn (Dukes et al., 2021) ('Context' section), the use of affective science frameworks in climate emotions and eco-emotions research is limited. With no scientifically agreed-upon definition of emotion, the domain continues to reflect "more controversy than consensus," with indiscriminate use of terms across the literature (Ekkekakis, 2013, p. 5). Yet the difference between the folk psychological concept of memory and the modern scientific understanding that memory is not one process underscores the importance of such conceptual distinctions (Russell, 2015). Prior eco-emotional frameworks (Hahnel & Brosch, 2018; Hiser & Lynch, 2021; Landmann, 2020), while insightful, were not based on the limited but emerging consensus in the affective domain. Ekkekakis (2013) undertook seminal work in identifying this consensus through a classification system that uses the lowest common denominators from current affective science theory with substantial convergence among researchers. This state-of-the-art framework distinguishes among three constructs: core affect, emotions, and moods (CAEM) (Ekkekakis, 2013). We applied this framework to eco-emotions research and thus to this study, focusing our investigative scope on core affect and emotions.

Providing the universal structure of emotion and accounting for all affective states across cultures (Jackson et al., 2019), core affect is defined as "a neurophysiological state consciously accessible as a simple primitive nonreflective feeling most evident in mood and emotion but always available to consciousness" (Russell & Barrett, 2009, p. 104). Core affect has two bipolar dimensions: valence/hedonic level (positive/pleasure vs. negative/displeasure) and activation/arousal level (high vs. low) (Russell & Barrett, 1999). We are always in some state of core affect; it ebbs and flows over time in its nature and intensity and is subject to various causal forces (Russell & Barrett, 2009). It can be 'pure' and free-floating or become directed: e.g., "pride can be thought of as feeling good about oneself, with the 'feeling good' part being core affect and the 'about oneself' being an additional (cognitive) component" that makes pride into an emotion (Russell, 2003, p. 148).

Contemporary definitions recognize that emotion "comprises multiple interconnected and coordinated components" (Ekkekakis, 2013, p. 41), making it "an episode of

interrelated, synchronized changes in the states of all or most of the five organismic subsystems in response to the evaluation of an external or internal stimulus event as relevant to major concerns of the organism" (Scherer, 2005, p. 697). These five subsystems, synthesized from definitions of 'emotional experience' (Frijda & Scherer, 2009), and 'prototypical emotional episode' (Russell & Barrett, 1999), consist of: (1) core affect, plus (2) information-processing cognitive appraisal, (3) neuro-physiological bodily changes, (4) expressive or overt behavior, such as vocal or facial expression, and (5) action tendencies. They tend to be high in intensity and short in duration (seconds to minutes), given their evolutionary adaptive function to quickly mobilize the organism (Ekman, 1992, p. 185).

Research Aims

Overall, there is an urgent need to better understand (1) the fuller range of GEC-associated emotions and (2) especially so in non-WEIRD contexts that are already disproportionately affected by the GEC and face heightened vulnerability due to cumulative stressors ('Context' and 'Research Gaps' sections). Here we address these two overarching research gaps through an exploratory but structured planetary affective science framework (sections 'Planetary Eco-Emotions Framework' and 'Affective Science Framework') in an understudied region. The Middle East is warming at nearly twice the global average rate and is especially vulnerable to extreme heat, drought, and air pollution (Zittis et al., 2022). Türkiye, i.e., Turkey or Turkiye,[2] is a middle-income developing country and biodiversity hotspot highly vulnerable to climate change and natural disasters (UNDP, 2023)—and thus vulnerability to cumulative trauma effects (Goenjian et al., 2022)—as evidenced by the 2023 earthquakes. Therefore, this exploratory study is framed by the question: What is the range and prevalence pattern of eco-emotions—defined by our planetary affective science framework—in the Turkish context, and how do these compare to prior findings across WEIRD and non-WEIRD contexts?

Method

Procedure and Measures

Using a qualitative study design, we developed a structured interview protocol with questions framed by the CAEM framework ('Affective Science Framework' section).[3] Our aims were to: (1) dimensionally assess the range and prevalence patterns of affective responses at the core affect and emotion measurement levels; and (2) test the plausibility of our planetary eco-emotions framework for capturing previously overlooked nuances

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2) The country officially changed its name to Türkiye at the United Nations in 2022.

3) See Appendix 1 in Voşki et al. (2023).

within the first aim. We operationalized the former by measuring personal assessments about environmental issues encompassing: (1a) the current state of the environment, (1b) the future/projected state of the environment, based on Gifford et al. (2009), and (1c) the environment/nature more generally, consistent with our planetary eco-emotions framework.

We hypothesized about potentially differentiated eco-emotional prevalence patterns ('Research Gaps' section) but could not make specific predictions due to the incompleteness and WEIRD-skewness of current eco-emotions data. As such, we included core affect in our measurement scope, in line with the CAEM framework recommendations when predictions cannot be made based on current theory (Ekkekakis, 2013, p. 73). We collected dimensional core affect data through participants' self-marked points on the circumplex model of affect (Russell, 1980), followed by oral responses to open-ended questions for the emotion-level data. Pilot testing with three international participants (Kenyan, Mexican, French) was conducted in July 2022, resulting in phrasing clarifications for non-native English speakers and linguistic alterations to reflect more collectivist cultural contexts (e.g., expanding some individual-focused questions to include participants' communities and families). This study received approval from Stanford University's Institutional Review Board (Protocol: IRB-66184), following all guidelines for research with human subjects.

Participants

The sample (*n* = 15) included five male and 10 female Turkish citizens (Table 1), with a mean age of 40.6 years (*SD* = 9.17). Participants' self-identified occupational categories were nine environmental scientists, three naturalists, and three environmental activists. A total of 16 participants were recruited using purposive sampling, but one was excluded because they were not a Turkish citizen. We recruited those engaged in environmental work, as previous studies have suggested that members of these groups may express heightened vulnerability to emotional distress due to their knowledge of and emotional ties to the natural world (Coffey et al., 2021). Recruitment was conducted by email and word of mouth between August and September 2022. The sample size was deemed sufficient for the scale of this exploratory study (Braun & Clarke, 2022), which sought to understand lived and situated experiences across a range of highly affected individual adults in a Turkish context.

Data Collection

Interviews were conducted between August and October 2022 in person across the city of Istanbul and southern Muğla province, as well as virtually (using the Zoom teleconferencing platform). Providing more specific locations would allow for identification of some participants and are thus not shared. The protocol was available in both English

Table 1

List of Study Participants

ID	Gender	Age	Occupational category	Years in occupation
P01	Female	28	Naturalist (Conservationist)	2
P02	Male	34	Environmental scientist/academic	4
P03	Female	30	Naturalist (Farmer)	3
P04	Male	42	Environmental scientist/academic	15
P05	Female	31	Environmental scientist/academic	9
P06	Male	36	Environmental activist	11
P07	Male	38	Environmental scientist/academic	18
P08	Male	61	Environmental scientist/academic	30
P09	Female	39	Environmental scientist/academic	15
P10	Female	44	Environmental activist	15
P11	Female	37	Environmental activist	13
P12	Female	58	Environmental scientist/academic	35
P13	Female	38	Environmental scientist/academic	14
P14	Female	48	Environmental scientist/academic	15
P15	Female	45	Naturalist (Birder)	25

Note. Study participants were all Turkish citizens. Data reported in Table 1 includes self-identified gender, age, occupational category, and years spent working in the environmental field.

and Turkish, with interviews conducted by AV [first author] primarily in English for linguistic and conceptual consistency, except for occasional word-specific translations. Interviews lasted between 51 minutes and 1 hour 25 minutes, with a mean length of 61 minutes (*SD* = 10.37). Interviewees were informed at the beginning of the interview that participation was voluntary, they could withdraw anytime, and their anonymity and confidentiality were guaranteed. Participants orally consented to participation and audio recording for transcription purposes.

Data Analysis

For the core affect-level data, we collated participants' self-marked points on the circumplex model (Section 'Core Affect'). For the emotion-level data (Sections 'Eco-Emotions'–'Environmental Concern: Planetary Eco-Emotions Framework'), we employed reflexive thematic analysis (RTA) for participants' answers (Braun & Clarke, 2022). Following anonymization of the data, audio recordings were transcribed using Otter.ai, a transcription software package. Each transcription file was reviewed to ensure accuracy and to begin AV's data familiarization. In accordance with RTA, AV inductively and semantically coded the dataset at the sentence and paragraph levels using NVivo, a qualitative data

analysis software (see Appendix 3 in Voşki et al., 2023), using multiple codes if the section contained multiple themes (e.g., two concurrent emotions or one emotion and the attributional appraisal of that emotion). Following multiple rounds of reflexive thematic clustering and refinement, GWP [second author] and NMA [third author] reviewed emergent codes and themes for accuracy and representativeness in December 2022.

Results and Discussion

Core Affect

Participants reported negatively valenced core affect in relation to environmental issues and positively valenced core affect in relation to the environment/nature, with both measures distributed across high activation/arousal (HA) and low activation/arousal (LA) states. 'Environmental issues' was operationalized as two measures (the current vs. the future/projected state of the environment), and the third measure (environment/nature) as the environment more generally/being in nature (Figure 2).
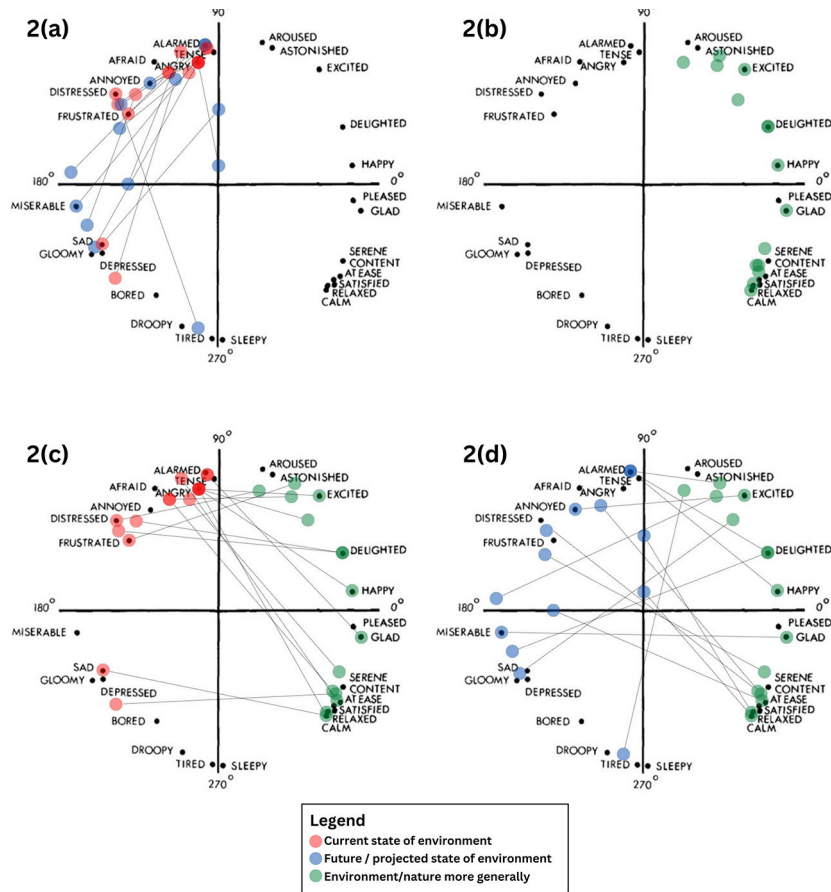
Environmental Issues (2a)

Participants reported negatively valenced core affect pertaining to environmental issues (Figure 2a), which we anticipated given the accelerating rate of environmental degradation and the nature of participants' professions (Coffey et al., 2021; IPCC, 2022). However, the two measures within environmental issues produced unexpected differences in activation level.

Current State of the Environment — Participants' responses on the current state of the environment overwhelmingly clustered in the HAN quadrant. The four responses on the "angry" label form the epicenter of the largest cluster for this measure: nine participants marked themselves near 90°, the highest possible activation level. In comparison, the second cluster in the HAN quadrant (four participants) shows relatively lower but more negatively valenced activation, while the third cluster (two participants) is in the LAN quadrant. We found participants' level of negative activation about the current state of the environment critically high, indicating elevated stress responses. When chronic, such sympathetic nervous system (fight-or-flight) activation is associated with significant long-term health consequences (APA, 2022). This finding provided preliminary evidence that participants' eco-emotional patterns may be more negatively valenced and/or higher activation than prior observations from WEIRD contexts ('Research Gaps' section), but further clarification was sought through participants' eco-emotional responses.

Figure 2

Dimensionality of Participants' Core Affect Pertaining to Issues of the Environment and Nature

Note. Figure 2 examines the dimensionality of participants' core affect pertaining to: environmental issues only (2a); the environment/nature only (2b); current state of the environment vs. environment/nature (2c); and future/projected state of the environment vs. environment/nature (2d). The x-axis represents valence (from 180° to 0°: negative to positive) and the y-axis represents activation/arousal (from 90° to 270°: high intensity to low intensity). The four quadrants represent the following: 0° to 90° is high-activation positive (HAP), 90° to 180° is high-activation negative (HAN), 180° to 270° is low-activation negative (LAN), and 270° to 0° is low-activation positive (LAP). Each participant is represented as one point per measure, with the lines connecting within-individual responses between the three measures. The color intensity of each point signifies the number of participants who selected that specific point as most representative: e.g., the point marked as 'angry' is the most intensive red because it was the most marked point on the model (by 4 out of 15 participants) for the current state of the environment measure.

Future/Projected State of the Environment — In comparison, participants' core affect in relation to the future/projected state of the environment follows a broader range of HAN/LAN activation. While most still cluster within the HAN quadrant, the overall activation pattern shows a relative downward trend with no distinct clustering. Three participants intersected on the "alarmed" label near 90°, while the two marks on the y-axis represent mixed valence. Increased psychological distance may play a role in both: (1) the greater consistency between participants' responses for this measure and prior observations in the WEIRD-skewed literature, and (2) the observed difference in activation levels between this and the previous measure ('Current State of the Environment' sub-section). Firstly, we would expect this measure to increase temporal distance toward the future across both WEIRD and non-WEIRD populations ('Research Gaps' section). Secondly, this distance may explain our participants' downward activation trend. These participants are already directly experiencing the GEC and the subsequently observed critical levels of negative activation. As such, reflecting on the future instead of the current state of the environment would decrease the stressor's proximity and immediacy (Maiella et al., 2020), consistent with the downward activation trend observed here.

Environment/Nature Generally (2b)

Participants reported positively valenced core affect pertaining to the environment/nature (Figure 2b), as expected, given our evolutionary predisposition to respond positively to nature (Barbiero & Berto, 2021). We observed even distribution between LAP and HAP activation ranges. The latter was somewhat unexpected given the stress reduction theory (SRT) of nature reducing autonomic activation/arousal through the parasympathetic nervous system, thus decreasing activation (Jimenez et al., 2021). Clarification was sought through participants' eco-emotional responses.

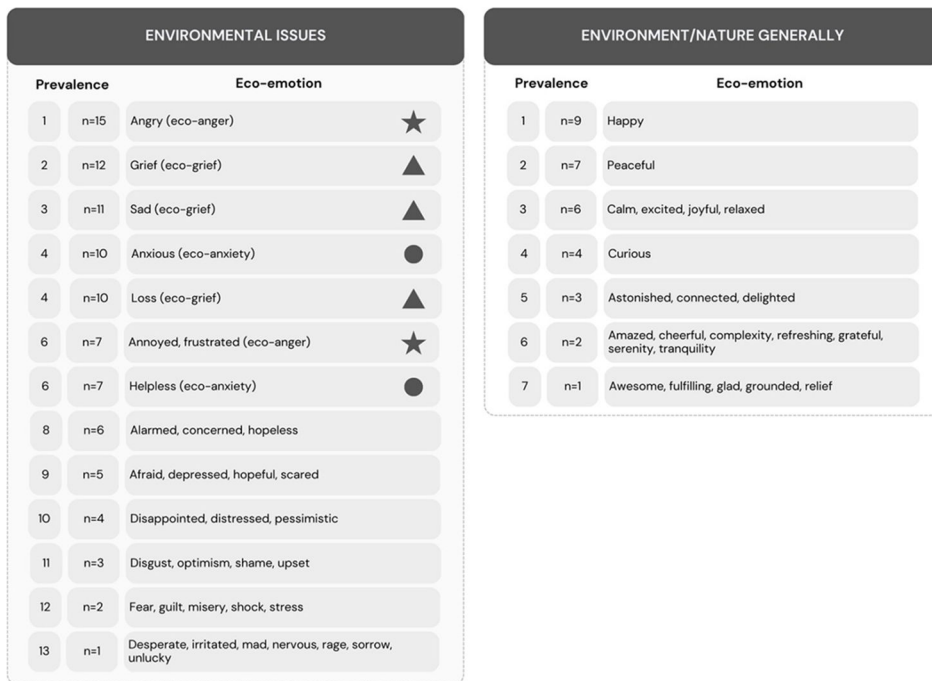### Environmental Issues vs. Environment/Nature (2c, 2d)

In comparing participants' negatively valenced responses to environmental issues versus positively valenced responses to the environment/nature, we found divergent activation trends. We observed a mostly downward but occasionally horizontal activation trend from the current state of the environment (Figure 2c). Given the critical levels of negative activation observed for this measure, we expected trends toward the environment/nature to show such a deactivating/calming effect, consistent with the SRT (Jimenez et al., 2021). However, for the future/projected state of the environment, we unexpectedly observed both upward and downward activation trends (Figure 2d). Participants in the HAN quadrant mostly showed a deactivation/calming effect when reflecting on the environment/nature, but those in or closer to the LAN quadrant showed an activation/mobilizing effect. While this potential counterbalancing effect of nature needs to be further investigated, it may indeed have an adaptive role in participants' regulation of negative affect consistent with prior findings (Westoby et al., 2022).

Eco-Emotions

Participants' reflections revealed a complex network of multi-component and interconnected eco-emotions—56 in total—about environmental issues and the environment/nature. As predicted by their core affect ('Core Affect' section), the former were negatively valenced while the latter positively valenced. However, unexpected prevalence patterns emerged in the specific types of negative eco-emotions observed, detailed below (Figure 3).

Figure 3

Prevalence Pattern of Participants' Eco-Emotions Based on Context-Appropriate Occurrences

ENVIRONMENTAL ISSUES			
Prevalence		**Eco-emotion**	
1	n=15	Angry (eco-anger)	★
2	n=12	Grief (eco-grief)	▲
3	n=11	Sad (eco-grief)	▲
4	n=10	Anxious (eco-anxiety)	●
4	n=10	Loss (eco-grief)	▲
6	n=7	Annoyed, frustrated (eco-anger)	★
6	n=7	Helpless (eco-anxiety)	●
8	n=6	Alarmed, concerned, hopeless	
9	n=5	Afraid, depressed, hopeful, scared	
10	n=4	Disappointed, distressed, pessimistic	
11	n=3	Disgust, optimism, shame, upset	
12	n=2	Fear, guilt, misery, shock, stress	
13	n=1	Desperate, irritated, mad, nervous, rage, sorrow, unlucky	

ENVIRONMENT/NATURE GENERALLY		
Prevalence		**Eco-emotion**
1	n=9	Happy
2	n=7	Peaceful
3	n=6	Calm, excited, joyful, relaxed
4	n=4	Curious
5	n=3	Astonished, connected, delighted
6	n=2	Amazed, cheerful, complexity, refreshing, grateful, serenity, tranquility
7	n=1	Awesome, fulfilling, glad, grounded, relief

Note. The entire list was included due to this study's exploratory purpose and its aim in mapping the full range of possible eco-emotions in our sample. For visual clarity, the star symbol marks emotions associated with eco-anger, the triangle with eco-grief, and the circle with eco-anxiety.

Environmental Issues

All participants described feeling angry, with most also expressing grief and grief-related sadness, anxiety, grief-related loss, annoyance, frustration, and helplessness about environmental issues (Figure 3). We interpreted eco-anger to encompass anger, annoyance, and frustration (Stanley et al., 2021); eco-grief to encompass grief, grief-related sadness,

and feelings of loss; and eco-anxiety to encompass feeling anxious and helpless, consistent with prior eco-emotional frameworks (Pihkala, 2022). Based on this interpretation, the three most prevalent eco-emotional clusters, representing approximately half or more participants ($n \geq 7$), were: (1) eco-anger, (2) eco-grief, and (3) eco-anxiety. Together with core affect ('Environmental Issues (2a)' section), this provided evidence that participants' eco-emotional patterns meaningfully differ from those presumed from the prior literature, with the prevalence of eco-anger and eco-grief over eco-anxiety as the most-often psychometrically assessed and observed in WEIRD populations (Hickman et al., 2021). This finding parallels Sultana's (2022) 'climate coloniality' work, which primarily details "collective trauma, grief and anger" experiences in the Global South (Sultana, 2022, p. 2), with the notable lack of the author's mention of anxiety other than its characterization in a footnote as "white anxiety in a brown planet" (Sultana, 2022, p. 6). As further illustration, participants' responses to a separate measure also confirmed the prevalence of eco-anger and eco-grief (Figure 4).

Figure 4

Frequency of Participants' Responses About Previous Emotional and Mental Health Challenges Related to Environmental Issues

Q13: In the past, have you experienced any emotional or mental health challenges related to environmental issues, such as: anxiety, anger, grief, depression, distress?
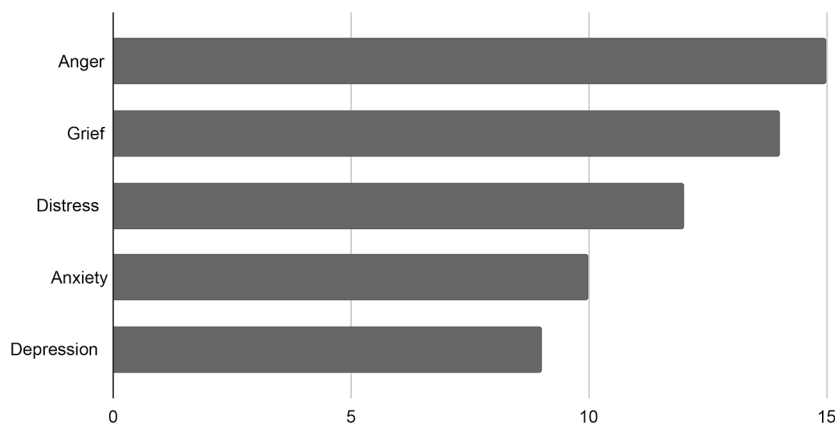
Current State of the Environment — Participants primarily expressed anger, frustration, alarm, distress, and annoyance about the current state of the environment. The following excerpts are representative:

> "*It's a mixture of distress, frustration, and being annoyed that is so close to angry*" [P14]; "*Frustration includes this helplessness and annoyance*" [P05]; "*The current state of the environment makes me concerned, makes me angry, makes me want to do something*" [P12]; "*It's a mixture of so many high [activation] negative feelings*" [P13].

We argue these responses reflect homogeneity consistent with our operationalization of eco-anger and participants' critically elevated HAN core affect ('Current State of the Environment' sub-section), thus implicating eco-anger as participants' primary eco-emotion about the current state of the environment.

Future/Projected State of the Environment — Participants conveyed a range of alarm, annoyance, anger, grief, sadness, frustration, distress, rage, pessimism, hopelessness, misery, anxiety, and fear about the future/projected state of the environment. These excerpts are representative:

> "*Definitely alarmed*" [P05]; "*Annoyed and angry*" [P07]; "*Depressed and sad but at the same time frustrated*" [P13]; "*Distressed or frustrated*" [P01]; "*I'm annoyed and frustrated and a little bit miserable about the future of our environment*" [P02]; and "*Annoyed, anxious and scared, because I know I will be very much affected by something that I cannot control*" [P03].

These responses reflect the heterogeneity observed in participants' range of HAN/LAN core affect for this measure (Section 'Future/Projected State of the Environment'). Consistent with our operationalization of eco-emotional clusters, we found participants' primary eco-emotions about the future/projected state of the environment to be eco-anger, eco-grief, and eco-anxiety, as well as emotions consistent with the literature's operational definitions of 'solastalgia' and eco-depression (Pihkala, 2022). Consistent with the WHO's (2022b) future-oriented definition of anxiety and predicted temporal increases in psychological distance in this context ('Research Gaps' section), eco-anxiety featured most prominently in this measure besides those listed above.

Environment/Nature

Participants reflected on the environment/nature measure as being in nature or thinking about nature and/or the overall environment. Most (n ≥ 7) associated it with feelings of happiness and peacefulness, others (n ≤ 6) with calmness, excitement, joy, relaxation, and curiosity (Figure 3). Responses reflected themes of nature connectedness and vividly

described nature imagery, exemplified for HAP as*: "a happy feeling, but it's more than that—it's being delighted"* [P14], and for LAP: *"I feel very relaxed by the seaside, the forest, the green, the blue"* [P02].[4] Some conveyed more complex or mixed conceptualizations through themes of awe, curiosity, and Islamic ecotheology.[5] This range is consistent with Pihkala's (2022) broad operational definition of many types of positive emotions. Given the lack of prior conceptual frameworks for positive eco-emotions, we argue the range of emotions observed for this measure is holistically captured by our proposed planetary eco-emotions framework, further discussed in the 'Environmental Concern: Planetary Eco-Emotions Framework' section.

We also found more evidence for this measure's counterbalancing effect on negative eco-emotions, consistent with our core affect findings (2c, 2d) and prior findings of nature helping to process negative emotions (Westoby et al., 2022). Deactivation changes (HAN→LAP) were described as: "*it makes me calm down*" [P15] and "*it's like my remedy*" [P04]; while activation changes (LAN→HAP) as: *"when I see a bird species that I haven't seen for some time, I feel really excited and astonished, so once again it's active"* [P15]; and "*if I'm in the field and we're having a good day, as in like, we're seeing an endangered species, then I feel extremely excited and connected to the cause and hopeful as well*" [P01].

Eco-Emotions in Environmental Disasters

In recounting direct experiences of anthropogenic environmental disasters—e.g., wild-fires, deforestation, pollution, biodiversity harm, and extreme weather—participants expressed acute stress and anxiety and subsequent eco-grief and eco-anger appraisal of these episodes. The majority mentioned the 2021 Turkish wildfires, describing immediate stress responses:

> "*For two weeks I was in a state of fight-or-flight where I couldn't concentrate on anything. I felt really anxious all the time. [...] It was very difficult for me to sleep and to enjoy or do anything*" [P01]; "*I couldn't sleep for several days*" [P08]; "*It was terrifying* [P13]; "*It was really making me anxious*" [P11].

These symptoms, especially sleep disturbances, are consistent with common post-disaster acute stress and anxiety responses (To et al., 2021). Subsequent reflections showed participant appraisal themes of grief and anger:

> "*I feel grief* " [P07]; "S*omething is lost and it's not going to go back to the original state*" [P13]; "*I think when an emergency situation is happening, and you don't see the appropriate response from the*

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4) See Appendix 2(a) in Voşki et al. (2023) for further quotes.

5) See Appendix 2(b) in Voşki et al. (2023) for quotes.

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> *government, it makes you extremely angry*" [P01]; "*I hear the voice of burning animals, the sound of collapsing trees [...] For several weeks, I was not in my mood, people asked me: you lost something? A beloved one? I said yes, I lost many animals, many trees. I was there. I was a witness. [...] This is why sometimes I'm angry with the government, who don't take educational or protective measures before fires.*" [P08]; "*Especially forest fires make me very angry*" [P12]; "*It's very upsetting. It's our land, it's our forest, it's our nature, it's our animals and it's our people*" [P10].

Concerning other types of disasters, participants primarily expressed eco-grief in relation to deforestation, eco-anger with pollution, eco-grief with biodiversity harm,[6] and climate anxiety with extreme weather events.[7] One participant expressed eco-grief about the rapid deforestation accompanying the mid-2010's construction of the Istanbul Airport in the city's most ecologically important region (Baş et al., 2018):

> "*We were trying to stop the process, but of course they started it and then the main lawyer took us to the field. [...] When I think of it, I feel like crying, it was like a trauma. First coming up the hill, it was all green. Then when we came down... this whole... like in front of us, it was literally empty. I mean, they cut every existing tree. It was all empty. It looked like a graveyard*" [P05].[8]

Eco-anger was primarily expressed about pollution, such as the "killing" [P05] or "dying" [P08] of the Marmara Sea, a recent marine mucilage explosion due to rising sea temperatures and wastewater pollution that has led to mass marine life mortality (Karadurmuş & Sari, 2022). One participant reflected:

> "*I felt that this is the end of the Marmara Sea. I thought the sea was gone. What does it mean that a sea was gone? This is a disaster and this is how people just consume the sea. So it is possible to pollute that much water [...] I'm getting angry*" [P12].

Similarly, another reflected on marine pollution through eco-anger:

> "*Now when I'm swimming in my hometown in the summer, I'm always taking some plastic out of the sea and I feel angry. Normally swimming is something that makes me relieved, happy, but maybe*

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6) See Appendix 2(g) in Voşki et al. (2023) for further quotes.

7) See Appendix 2(h) in Voşki et al. (2023) for quotes.

8) See Appendix 2(f) in Voşki et al. (2023) for further quotes.

> *10 years later we will stop swimming because there will be trash
> everywhere*" [P15].

Overall, the subsequent accounts of mourning and loss detailed in the quotes above are consistent with the post-disaster eco-grief literature (To et al., 2021). Anger is a prominent but commonly overlooked post-traumatic response to disaster events (Cowlishaw et al., 2021). Current climate emotions and eco-emotions research also suffers from this omission (Pihkala, 2022), despite eco-anger playing an important role in our participants' post-traumatic responses. This underscores that future research and interventions in disaster-contexts must also incorporate eco-anger measures, especially in communities and countries disproportionately suffering from anthropogenic environmental disasters and thus with predisposed vulnerability to cumulative trauma effects (Goenjian et al., 2022).

Emotion Regulation and Coping Strategies

In the overall context of negative eco-emotions, the most frequently mentioned emotion regulation and coping strategies were: (1) engaging in individual-level pro-environmental behaviors,[9] and conceptualizing choice of occupation—whether as a scientist, naturalist, or activist—as part of those behaviors,[10] and (2) avoidance and distraction.[11] Mentions of collective-level pro-environmental behaviors were limited, possibly due to violent governmental crackdowns on environmental protests (Kurtiç, 2022). Participants may face significant barriers to collective behaviors, consistent with the literature predicting this issue specifically for Global South populations (Ogunbode et al., 2022). One participant explained that "*it's very common in Türkiye to threaten someone*" and speaking of environmental activists, added, "*they will be targeted by governmental actors*" [P05]. Therefore, such limited psychological and behavioral outlet opportunities may also explain the observed prevalence of avoidance and distraction.

Contextual Factors

Country-Level Attribution

Most participants attributed country-level responsibility for the current state of the environment to the Turkish government, with the appraisal theme of eco-anger exemplified as:

> "*I feel angry about the inaction of the government's handling of the
> environment, and this is also annoying me*" [P07]; "*I definitely feel*

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9) See Appendix 2(c) in Voşki et al. (2023) for quotes.

10) See Appendix 2(d) in Voşki et al. (2023) for quotes.

11) See Appendix 2(e) in Voşki et al. (2023) for quotes.

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> *annoyed, then I blame the governors*" [P05]; "*This current government,
> they're against nature*" [P10].

These attributional themes are consistent with prior findings about inadequate governmental response to climate change leading to HAN eco-emotions such as anger, anguish, and anxiety in a 32-country youth sample (Hickman et al., 2021).

Participants' further responses revealed two unexpected contextual dimensions that may play an important role in shaping their eco-emotional patterns: (1) a developing country tension and (2) a self-efficacy dimension. In reference to the former, some contextualized Türkiye as being part of the Global South in terms of historical responsibility for environmental degradation and still trying to meet its citizens' basic needs [P13], but also "*striving to be part of the Global North*" and thus increasing its present contribution to the GEC [P14].[12] This tension implies that middle-income developing country populations such as those in Türkiye may be witnessing more intensive and rapid environmental degradation in contrast to those living in high-income developed countries that have already consumed most of their formerly intact natural resources for development (e.g., old-growth forests in the United Kingdom). This may also contribute to more negatively valenced and/or higher-activation emotions in such populations. Similarly, participants' responses of limited self-efficacy[13]—the perception of their ability to attain desired results—is consistent with prior barriers and limited outlets discussed above ('Emotion Regulation and Coping Strategies' sub-section).

Global-Level Attribution

Participants overwhelmingly attributed global-level responsibility for the current state of the environment to WEIRD/Global North countries, contextualized with firsthand experiences of environmental injustice and strong appraisal themes of eco-anger.

Global North Responsibility — The following excerpts are representative of these attributions:

> "*Western countries caused this environmental condition, they used our
> lives on the environment, so they should care about the environment
> on our side because they used our rights*" [P02]; "*Türkiye, Arabic
> countries, we are unfortunately third world countries, but USA, Eng-
> land, Canada, they are like a castle, they incurred all these problems*"
> [P03]; "*We sell [raw materials] to Europe, US, but the costs are paid
> here*" [P06]; "*The West already polluted and colonized the world and
> they're having fun. So why shouldn't China and India and Türkiye and*

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12) See Appendix 2(i) in Voşki et al. (2023) for further quotes.

13) See Appendix 2(j) in Voşki et al. (2023) for quotes.

> *Russia? The math is very obvious – who polluted, who did not pay for it, and who suffered from it*" [P04].

Some participants emphasized nuance by partially attributing responsibility to non-WEIRD countries with increasing environmental footprints,[14] consistent with our 'developing country tension' dimension finding ('Country-Level Attribution' section).

Environmental Justice — In detailing direct experiences of environmental injustice, anger emerged as the most prominent eco-emotional theme:

> "*I'm enraged by the environmental injustice [...] I feel like we should just burn it all [...] this is very unjust*" [P09]; "*There's a sense of injustice and it makes me angry [...] because it's beyond my reach*" [P14]; "*I'm very angry with the responsible countries [...] This feeling makes me more reactive to environmental conditions*" [P02]; "*[In the textile industry] we were doing chemical washes, different kinds of modern fashion looks, using very dirty and poisonous stuff and I was always very irritated by it. I was like, why? Just to make somebody look pretty?*" [P10].

Some participants expressed feelings of worthlessness in the context of this injustice, exemplified by the following two excerpts:

> "*As a person from the Global South, I feel like I don't have any solution and option. I feel very hopeless, really unlucky actually*" [P07]; "*England has been taking lots of garbage to Adana. [...] They are burning and we breathe it all. Of course, I feel like a garbage. Why should I feel like that? I feel that I'm not important, I'm nothing, I'm alive or not, no one cares. Because if my country is a garbage, what am I? Why my country takes other countries' garbage? Because we are not an important country*" [P03].

Overall, there is strong evidence of a directly experienced environmental justice dimension. As one participant added: "*People often underestimate the trigger of the feeling of injustice*" [P05]. These responses reflect the same eco-anger and blame toward northern countries observed previously in climate activists from the Global South (Kleres & Wettergren, 2017) and underscore that rage is indeed not equivalent nor experienced the same everywhere (Sultana, 2022). Thus, this dimension appears to play a key role in the observed prevalence of eco-anger in non-WEIRD contexts, but further studies are needed to more precisely map associations.

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14) See Appendix 2(k) in Voşki et al. (2023) for quotes.

Environmental Concern: Planetary Eco-Emotions Framework

All participants said the environment is in crisis. Most expressed holistic concern about the GEC, given the interconnected nature of environmental issues; others emphasized equal amounts of issue-specific concern about biodiversity loss, climate change, and freshwater use, with some mentions of ocean acidification and pollution.[15] These responses, holistically encompassing all environmental issues as well as specific PB issues, are consistent with our planetary eco-emotions framework ('Planetary Eco-Emotions Framework' sub-section). For example, we unexpectedly found the freshwater PB to be one of participants' top three issue-specific concerns, which they attributed to ongoing water shortages in the Middle East region,[16] also consistent with Ethiopian findings about pastoralists' HAN emotions associated specifically with freshwater scarcity (Cooper et al., 2019). We contextualize participants' equal emphasis on biodiversity loss and reported high levels of eco-grief ('Eco-Emotions' section) with Türkiye being a biodiversity hotspot. Overall findings demonstrate that this framework effectively captures participants' range of positive and negative eco-emotions, both holistically and with regional and contextual nuances.

Conclusion

This exploratory study theoretically advances eco-emotions research in two ways. First, it addresses a significant gap by introducing a new framework for eco-emotions that, to the best of our knowledge, is the first to use the planetary boundaries (PBs) concept. Second, it emphasizes construct clarity by applying the CAEM framework to scientifically differentiate between affective constructs and by using state-of-the-art dimensional emotion measurement. Empirically, this study provides new and unexpected insights into core affect and the range of eco-emotions in an understudied, non-WEIRD context. Eco-anger was the most common negative eco-emotion, followed by eco-grief and eco-anxiety, indicating that our Turkish participants' eco-emotional patterns are meaningfully differentiated from the anxiety-prevalence patterns most prominently observed in WEIRD contexts to date. Similar eco-emotional findings in post-disaster contexts underscore participants' heightened vulnerability to cumulative stressors and trauma exposure effects. We identify five important contextual factors in these differentiated eco-emotional patterns: the dimensions of (1) environmental justice, (2) 'developing country tension', and (3) self-efficacy; and the themes of attributing responsibility to (4) the Turkish government nationally and (5) the Global North internationally.

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15) See Appendix 2(l) in Voşki et al. (2023) for quotes.

16) See Appendix 2(m) in Voşki et al. (2023) for quotes.

These findings constitute the first step toward more holistic and globally representative eco-emotions assessment, urgently needed both for context- and culturally dependent pro-environmental interventions and for effectively responding to the adverse physical and psychological health effects of the intensifying GEC. Limitations include lack of generalizability due to the exploratory nature of this study and potential self-selection bias—i.e., some potential participants may not have felt safe to participate due to the current political climate and violent crackdowns on environmental protests (Kurtiç, 2022). Further, while the observed eco-anger prevalence patterns are consistent with prior findings from the Global South, they may also relate to participants' environmental occupations and heightened nature connectedness. Future research mapping the fuller range of eco-emotions—especially beyond WEIRD contexts and in understudied regions with heightened vulnerability due to cumulative stressors such as in the Middle East—is recommended to expand upon our findings.

Openness and Transparency Statements

The present article has been checked by its handling editor(s) for compliance with the journal's open science and transparency policies. The completed *Transparency Checklist* is publicly available at:

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Ethics Statement. This study received approval from Stanford University's Institutional Review Board following all guidelines for research with human subjects.

Diversity Statement. In the list below, the check mark (☑) indicates which steps were taken to increase diversity within the context of this paper. Steps that were not taken or did not apply are unmarked (☐).

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- ☑ Author(s) from sampled population (avoiding 'helicopter science')

Supplementary Materials. The following table provides an overview of the accessibility of supplementary materials (if any) for this paper.

Type of supplementary materials	Availability/Access
Data	
a) Interview data (audio recordings and transcripts)	Data are not accessible because participants did not provide consent and participants' identities could be revealed despite anonymization of transcripts.
b) Interview questions (structured interview protocol), quotes, codebook	Voşki et al., 2023
Code	
No code to share.	—
Material	
No materials to share.	—
Study/Analysis preregistration	
The study was not preregistered.	—

Badges for Good Research Practices.

Open data: NO.

Open code: NO.

Open materials: NO.

Preregistration: NO.

Diversity statement: YES.

Note: YES = the present article meets the criteria for awarding the badge. NO = the present article does not meet the criteria for awarding the badge *or* the criteria are not applicable.

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