frontiers in Climate

ORIGINAL RESEARCH
published: 14 January 2022
doi: 10.3389/fclim.2021.738154

Toward a Taxonomy of Climate Emotions

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There is a growing evidence that emotions shape people's reactions to the climate crisis in profound but complex ways. Climate emotions are related to resilience, climate action, and psychological well-being and health. However, there is currently a lack of research about the array of various climate emotions. There is also a need for more integration with general research about emotions. This article conducts a preliminary exploration of the taxonomy of climate emotions, based on literature reviews and philosophical discussion. The term emotion is used here in a broad sense, as is common in climate emotion research. Because of the urgency of the climate crisis and the lack of previous research, this kind of exploration is aimed to be helpful for both practical climate work and for future research which would include more systematic reviews of the topic. Research items which discuss at least five different climate emotions, based on empirical observations, are used as major sources and a table about them is provided. Climate emotions are discussed on the basis of interdisciplinary research. The article considers many aspects of the phenomena of climate anxiety and climate grief.

Keywords: eco-anxiety, climate anxiety, climate change, emotion, feeling, affect, ecological grief, eco-anger

OPEN ACCESS

Edited by:
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Reviewed by:
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Specialty section:
This article was submitted to Climate Risk Management, a section of the journal Frontiers in Climate

Received: *08 July 2021*
Accepted: *21 December 2021*
Published: *14 January 2022*

Citation:
Pihkala P (2022) Toward a Taxonomy of Climate Emotions. Front. Clim. 3:738154. doi: 10.3389/fclim.2021.738154

INTRODUCTION

The Significance of Climate Emotions

The climate crisis is rapidly growing more intense globally. In the 2000s, scholars have started to pay more attention to the complex ways in which emotions are related to the climate crisis. This topic is sometimes called the affective dimension of climate change: broadly, it includes many kinds of affective phenomena which are called by different words in various disciplines, including feelings, emotions, affects, and moods (Smith and Leiserowitz, 2014; Hamilton, 2020). In this article, the concept of emotion is used as a general term for these phenomena, which is a usual method in related research (Gonzáles-Hidalgo and Zografos, 2020; Landmann, 2020; Neckel and Hasenfratz, 2021). Climate emotions are defined as affective phenomena which are significantly related to the climate crisis, even though there may be many kinds of factors influencing people's emotions at a certain moment—such as the general situation in one's life, one's temperament, daily events, social dynamics, and climate change impacts (see the discussion of various factors in Gonzáles-Hidalgo and Zografos, 2020; Hamilton, 2020).

Emotions are related to the climate crisis in many ways. The various phenomena related to the crisis cause various emotions in people and many contextual factors have an effect on them. Climate emotions have been found to be related to for example behavioral reactions (e.g., Nabi et al., 2018), psychological well-being and health (e.g., Berry et al., 2018), and to moral issues (e.g., McQueen, 2021). These kind of dynamics have been much discussed in general emotion research (see Barrett et al., 2016), and while research on climate emotions has started to draw from that research, more integration would be needed.

The practical dimension of climate emotions is seen for example in the efforts of researchers, communicators and educators in seeking for emotions which would support pro-environmental behavior. It has been pondered how emotions could be evoked or channeled in ways which would promote resilient behavior both on individual and collective levels (Salas Reyes et al., 2021). Research is ongoing and it has been found that climate emotions do indeed influence behavior significantly, but the dynamics seem to be very complex and there are no simple solutions to these practical questions (Chapman et al., 2017). For example, various researchers have argued whether guilt or pride would be a better motivation for pro-environmental behavior, but recent research suggests that this may be case-dependent and many contextual factors include the dynamics (Adams et al., 2020). Thus, there is a need for more research about the relationship between various emotions, climate action, and contextual dynamics. A fuller knowledge about the array of various climate emotions can help in this research.

A growing body of research has found that climate emotions are connected in complex ways with psychological well-being and health. This research has often focused on varieties of worry, anxiety, and grief (Ojala et al., 2021). Many observations about various emotions have been made in this research, but there is a need to know more about the array of emotions related to these issues.

Another major area related to climate emotions is morality and ethics. There are numerous ethical issues related to the climate crisis, and emotions play various roles in them. Some climate emotions have been discussed as moral emotions, especially guilt, shame, anger, and grief (Cunsolo Willox and Landman, 2017; Jensen, 2019; Antadze, 2020; Pihkala, 2020a), but more research is needed about the various moral emotions related to the climate crisis.

There thus emerges a task to explore further the various climate emotions that can exist. This task is made more intense by the strong urgency of the climate crisis, which is worsening rapidly. This research article engages in that task. The aims will be discussed in more depth after reviewing briefly the history of eco-emotion research, especially as it relates to climate emotions and to the task of this article.

A Brief History of Research on Eco-Emotions

Scholarship on the affective dimensions of environmental problems is now growing fast (Gonzáles-Hidalgo and Zografos, 2020; Ojala et al., 2021; Salas Reyes et al., 2021). This can be seen as a welcomed change, since for many years the affective dimension was neglected. While already in the early 2000s some pioneering scholars started to explore the various emotions that can be related to environmental issues (Böhm, 2003), research remained scarce for long (for an early overview, see Kals and Müller, 2012). Important milestones in this process have been the formulation of the concept of solastalgia, which means place-related sadness and other related emotions (Albrecht et al., 2007), and the generally growing interest about "eco-anxiety," the psychological impacts of the ecological crises (for early reflections, see Fritze et al., 2008). In the background, there was pioneering work in eco-psychology about ecological grief and other difficult "eco-emotions:" emotions which are significantly related to ecological issues (e.g., Macy, 1983; Glendinning, 1994/2007). With the rise of interest, this older eco-psychological material gained more attention (Buzzell and Chalquist, 2009).

In the 2010s, there was growing research about the relationship between emotions and pro-environmental behavior (Salas Reyes et al., 2021). During the final years of the 2010s, eco-anxiety and climate anxiety became much-discussed topics in media (Pihkala, 2020a), and scholars started to extend the research on a broader range of emotions and mental states (Albrecht, 2019). The term mental state is here used to refer to phenomena which often include emotions, but consist also of other things and can be temporally longer: a prime example is how anxiety can feature both as an emotion and a mental state (cf. Kurth, 2018).

Climate change, which started to be called the climate crisis, became gradually a focal point in research and discussion about eco-emotions. Research on climate emotions began to grow (e.g., Nabi et al., 2018; Wang et al., 2018). There is also a recent wave of popular, partly research-based books which focus on the broad topics of climate anxiety and/or climate grief, but include discussion about many emotions (e.g., Gillespie, 2020; Ray, 2020; Salamon, 2020; Newby, 2021).

General research about emotions is a very wide field, and there are numerous different ways that researchers from various disciplines use related terms, such as feeling, affect, and mood (for overviews of emotion research, see Barrett et al., 2016; Scarantino, 2016). Also in research about climate emotions, there also be discerned many different terminological approaches. Some scholars operate with a more narrow definition of emotion, as many emotion researchers do: in this approach, "emotion" means conscious feelings that can be named and which have an object. Others use the concept of emotion broadly to describe a wide array of feelings, including both unconscious bodily feelings and conscious experiences of feelings (for an overview, see Hamilton, 2020, p. 35). This broad use is very common in both public discussion and interdisciplinary research, although some researchers prefer to use the concept "feeling" as the broad term.

Furthermore, the rise of affect studies has brought new attention to both the immediacy of feeling and the collective aspects of feeling (Gregg and Seigworth, 2010). The concept of "affect" is usually used to refer to unconscious bodily feelings, but there are various uses of the term (see, for example, the definition of "ecological affect" by Cunsolo Willox et al., 2013). The rise of affect studies has generated new disputes around emotion terminology, and the whole field of emotion theory is experiencing some turbulence (e.g., Scarantino and de Sousa, 2018). In research about climate emotions, significant scholarship has recently been made which utilizes affect theories (e.g., Bristow, 2019; Hamilton, 2020; Verlie, 2022; about eco-emotions and affect theory more broadly, see Bladow and Ladino, 2018b). This plurality and complexity in emotion theory provides challenges for climate emotion research and leads to the research tasks of this article.

Aims of the Research

As was mentioned above, researchers and those who work with climate action are growingly trying to explore people's climate emotions, both for the sake of simply understanding people and for the sake of channeling emotional energy to constructive responses to climate risks (e.g., Nabi et al., 2018; Wang et al., 2018; Verlie, 2019; Hamilton, 2020; Salas Reyes et al., 2021). In these endeavors, the plurality of emotion theories brings certain challenges: what theories should or could be used to capture important aspects of people's climate emotions? Usually the studies simply observe certain emotions and do not use any wider frame or taxonomy. Knowing more about the scope of various climate emotions would help to explore them further in both research and practice. In the current situation, it is possible that certain important climate emotions have received very little or no attention in research, because of the lack of frameworks and taxonomies—and because of the relatively new character of climate emotion research as a field.

Recently, Hiser and Lynch (2021) insightfully explored university students' climate emotions and decided to use psychologist Robert Plutchik's theory of emotions and micro-emotions, and some younger scholars have already picked up this approach (Coppola, 2021). Plutchik is one of those researchers who have tried to capture basic, primary or universal emotions: emotions which could be recognized around the world *via* facial expressions and other signs (Scarantino, 2016). Several scholars, such as Ekman & Cordaro, Izard, Levenson, and Panksepp have proposed slightly different lists of basic emotions. For example, Ekman and Cordaro proposed seven basic emotions in the strict sense: happiness, sadness, fear, anger, disgust, contempt, and surprise (see overviews and analysis in Tracy and Randles, 2011). There is much ongoing debate about these influential theories. Some scholars oppose the whole idea of universal emotions and emphasize the role of the social, cultural and linguistic context for emotions. Others emphasize the cognitive construction of emotions (for a useful overview of these theories and debates, see Scarantino, 2016).

It seems that it will not be easy to capture all relevant climate emotions by using any of these theories of basic emotions. First, the lists differ from each other, and it is difficult to choose which one to use. Second, because the climate crisis is a deeply moral issue, there are numerous moral emotions at play here. All of these emotions are not well-captured by theories of basic emotions: for example, guilt features prominently as a climate emotion (e.g., Jensen, 2019), and neither Plutchik or Ekman included guilt in their lists of basic emotions. This has led scholars to add moral emotions to taxonomies of eco-emotions (cf. Böhm, 2003; Landmann, 2020). Also Hiser and Lynch (2021) decided to modify the taxonomy of Plutchik in their analysis: they replaced disgust with shame.

One of the only wider efforts to provide a taxonomy of environmentally relevant emotions is the insightful article by Landmann (2020), which brings together earlier research and makes new proposals. Her proposal is the following: "Self-condemning Emotions (Guilt, Shame, Embarrassment), Other-condemning Emotions (Anger, Disgust, Contempt), Self-praising Emotions (Pride), Other-praising Emotions (Elevation, Admiration, Awe, Being Moved, Gratitude, Love), Other-suffering Emotions (Compassion, Empathy, Emotional Contagion), Threat-related Emotions (Fear, Anxiety, Hopelessness), Hedonistic Emotions (Joy, Pleasure, Amusement)" (Landmann, 2020). This taxonomy is given special consideration in this research article. It is peculiar that sadness or grief is not included in Landmann's scheme, although her research article mentions those emotions. Another striking omission is hope: hopelessness is included, but not hope.

The aim of this interdisciplinary research article is to further explore the array of prominent climate emotions. It continues the insightful work of scholars such as Landmann (2020) who have tried to bring more clarity to the array of eco-emotions (see also Hahnel and Brosch, 2018), but focuses on climate emotions and reviews the topic in the light of interdisciplinary research and literature. Scholars have called for increased attention to the wide variety of possible climate emotions (Neckel and Hasenfratz, 2021). This article aims to identify gaps in the literature and to construct a preliminary taxonomy of various prominent climate emotions. This is an initial research venture and more work will be needed in the future to validate and possibly extend or modify the taxonomy. However, the taxonomy aims to already now inform research about pro-environmental behavior, to help develop therapeutic interventions and to foster personal insight. It may also contribute to thinking about public health policies in relation to climate change. The article aims to increase our knowledge about climate emotions, which makes it possible to apply its results and insights in behavior or influence programs. The great urgency of the climate crisis highlights the need for climate research, including this preliminary study of the array of climate emotions.

The major research questions are:

- Which climate emotions feature prominently in existing research?
- Based on (a) general emotion research and (b) interdisciplinary research on eco-emotions, which climate emotions would seem to deserve more attention, even though they have not yet been much studied in relation to the climate crisis?
- What could a taxonomy of the prominent and potentially prominent climate emotions look like?
- What kind of observations about these climate emotions can be made on the basis of an interdisciplinary discussion about them?

The first three research questions are addressed in Results and the fourth one in Discussion. Methodologically, the article is a combination of literature reviews and philosophical discussion. It provides a semi-structural review (Snyder, 2019) and the Discussion forms a narrative review. Existing scholarship about climate emotions is reviewed and it is discussed in relation to interdisciplinary environmental research. The taxonomy that is constructed is not a taxonomy in the strict sense, as used in some natural sciences: there is much debate in emotion research about taxonomies and the relations between various emotions

TABLE 1 | Climate emotions in key sources.

References	Nature of the source and field of study	People whose emotions are discussed	Method	Climate emotions and feelings notably discussed	Mental states discussed
Caillaud et al. (2019)	Research article, ecopsychology	145 French and 92 German students of psychology	Questionnaire about collective emotions	Embarrassment, empathy, fear, guilt, indignation, sadness, surprise	
Cunsolo Willox et al. (2013)	Research article, emotions and human geography	70 Inuit in Labrador, Canada	In-depth interviews	Anger, anxiety, depression, disorientation, fear, frustration, sadness, feeling uncertainty, worry	
Hamilton (2020)	Dissertation (DPhil), human geography and other disciplines	General observations, empirical material related to participants of eco-emotional workshops	Analysis of "emotional methodologies" in relation to eco-emotions	Much discussion about anger, anxiety, fear, grief, hope and hopelessness. Many other emotions discussed more briefly, such as despair, empathy, feeling troubled and disturbed, frustration, guilt, love, overwhelm, sadness, shame	Anxiety, depression, melancholia, numbness, trauma
Hickman et al. (2021)	Research article, planetary health	10,000 Children and young people (16–25 y) from 10 different countries	Online survey by Kantar TNS, interdisciplinary analysis	Survey included: anger, anxiety, betrayed, despair, fear ("afraid"), grief, guilt, helplessness, hurt, indifferent, optimistic, powerlessness, sadness, shame ("feeling ashamed")	Abandonment, anxiety, depression
Hiser and Lynch (2021)	Research article, education and community engagement	150 undergraduate students at University of Hawai'i	Semistructured focus group interviews	Use of five emotional categories: anger, fear, hope, sadness, shame. Mention of disappointment, frustration, hopelessness, feeling inspired, overwhelm, powerlessness, worry	Anxiety, numbness, panic, shock
Hyry (2019)	Report	2070 Finns (age 15+ years), a representative sample	Online survey by Kantar TNS	People were asked about 26 climate emotions and all gained at least some recognition: anger, anxiety, aversion, boredom, dejection, depressive feelings, desire for reparation, empowerment, excitement, fear, feeling of meaninglessness, frustration, grief, guilt, hope, feeling inadequacy, interest, irritability, powerlessness, rage, rejection/denial, remorse, skepticism/doubt, shame, stagnation	Anxiety, depression, strong fear
Jovarauskaite and Böhm (2020)	Research article, climate risk research	215 Lithuanian climate experts	Questionnaire	Contempt, disappointment, fear, guilt, hopelessness, indignation, regret, sadness, shame, sympathy, worry	
Kleres and Wettergren (2017)	Research article, social movement studies	Climate activists from North and South	Qualitative interviews, theoretical discussion	Focus on anger, fear, guilt, hope. worry included under fear. Discussion about feeling motivated.	
Marczak et al. (2021) (preprint)	Preprint of research article, climate psychology	A diverse sample of 33 people in Norway	In-depth interviews	Alienation, anger, anxiety, confusion, consolation (in natural environments), feeling depressed, despair, disappointment, disgust, disillusion, distrust, empowerment, fear, frustration, fury, gratitude, grief, guilt, hope, hopelessness, insecurity, irritation, isolation, loneliness, overwhelm, powerlessness, rage, feeling responsibility, restlessness, sadness, skepticism, shame ("ashamed"), terror, urge to act, worry	Anxiety, depression, "having a breakdown," negative rumination
Martiskainen et al. (2020)	Research article	Climate protesters in 6 cities	Interviews, theoretical discussion	Anger, anxiety, concern, despair, disempowered, fear, hopeful, hopelessness ("loss of hope"), sadness, feeling "strong." "Motivations" discussed separately from emotions.	Numb ("no emotions")
Minor et al. (2019)	Report	646 Greenland residents	National survey in Greenland	Angry, disgusted, fear ("afraid"), guilty, happy, hopeful, hopelessness, sad	

(Continued)

TABLE 1 | Continued

References	Nature of the source and field of study	People whose emotions are discussed	Method	Climate emotions and feelings notably discussed	Mental states discussed
Ojala (2012a)	Research article, environmental psychology	293 Swedish 12-year-olds	Questionnaire	Fear ("felt scared"), isolation/loneliness ("felt like others don't like me"), joy ("i have laughed," "felt happy"), sadness ("felt sad"), unhappy ("not felt happy," "down and unhappy"), worry ("felt worried")	
Smith and Leiserowitz (2014)	Research article, risk analysis	Nationally representative American sample, 1,001 adult respondents	Online survey by Knowledge Networks	Anger, depressed, disgusted, fear ("afraid"), guilty, helpless, hopeful, interested, sadness, worried	
Verlie (2019)	Research article, environmental education and affect studies	Undergraduate sustainability students in Australia	Theoretical discussion based partly on empirical observations	Focus on anxiety, frustration, grief, guilt, hope, overwhelm, sadness. Mention of disappointment and several other emotions.	Depression, trauma
Verlie et al. (2020)	Research article, environmental education	32 Australian environmental educators' views of their students' eco-emotions	Online survey, study co-conducted by undergrad students	Anger, anxiety, bored, frustration, guilt, hope, hopelessness, isolated/lonely, overwhelm, resentment, sadness. Brief mentions of many other emotions.	Anxiety, apathy, distress, restlessness, uneasiness

Included are peer-reviewed studies and published survey reports which discuss at least five different climate emotions with at least some empirical support. The exception is that one preprint, Marczak et al. (2021), is included because it directly observes a variety of climate emotions.
Emotion and feeling words are in alphabetical order. Some emotions have been coded and the original term is in brackets, for example Fear ("afraid").
Anxiety and Depression are listed both as emotions and, if strong forms of them are discussed, as mental states.

(Scarantino, 2016). This is a preliminary taxonomy of climate emotions, an initial effort to move toward a fuller understanding of the scope of climate emotions.

The structure of this article is as follows. First, the methods and materials are portrayed. In Results, the outcomes of the review of existing studies are presented and a proposition for a taxonomy of climate emotions is made. In the rather long Discussion section, these emotions are discussed from the point of view of interdisciplinary environmental studies. Finally, strengths and limitations of the study, along with important themes for further research are explored.

MATERIALS AND METHODS

Methodologically, this study is situated in interdisciplinary environmental research. It is a combination of a semi-structural review (Snyder, 2019) and a narrative review. Literature reviews and various forms of philosophical analysis are used to explore emotions related to climate change and the climate crisis. These are called climate emotions. The term emotion is used broadly, following the trend in related research (cf. Gonzáles-Hidalgo and Zografos, 2020; Landmann, 2020; Neckel and Hasenfratz, 2021). When the issue is evaluated from the perspectives of various branches in research about emotion, feeling, and affect, it becomes clear that this broad concept of climate emotion—and its upper-level terms, eco-emotions (Stanley et al., 2021) or "Earth emotions" (Albrecht, 2019)—includes many kinds of affects, feelings, emotions, and moods (Gonzáles-Hidalgo and Zografos, 2020; Hamilton, 2020). In other words, the use of terms in related studies varies and scholars seem to depict various kinds of affective phenomena with the term emotion. In this research article, it was decided not to try to discuss the various meanings that different scholars give to the term emotion, since that would be a huge task. The aim is to provide resources for further research which may bring more clarity about the various affective forms related to "climate emotions," such as affects (Cunsolo Willox et al., 2013), bodily feelings, and moods (see also Landmann, 2020; Salas Reyes et al., 2021).

The varied character of relevant sources provided methodological challenges. Climate emotions are discussed with various terms. Some studies focus on these subjects, while others discuss it only as one part of their research agenda. Some emotions have been researched more, while others have remained in the shade. As was seen in the Introduction, the research field is new and complex, and the complexities of emotion research in general make it even more difficult. Furthermore, the existing studies have charted only the climate emotions of certain people in certain places and countries. It is impossible to make strong claims of universality of any single climate emotion on the basis of existing research or even to compare all the studies with each other, because the studies, their methods, their subjects, and their linguistic choices differ.

It is also clear that climate emotions may be difficult to perceive even when effort is made to do so. There is a growing body of research which shows that social norms and psychosocial factors may prevent either participants or even researchers from noticing difficult emotions, such as shame or sadness (e.g., Norgaard, 2011; Lertzman, 2015; Stoknes, 2015; Hoggett, 2019). Several large surveys have been made about climate emotions, but they rely on people's self-recognition skills, and it seems

evident that some climate emotions are easier to notice or admit than others. Dynamics related to identities may influence people's perceptions: they may not wish to admit to feel certain climate emotions. A profound array of factors influences people's—including researchers'—abilities and willingness to recognize climate emotions, including cultural influences, social norms and traditions, worldviews and religions, personality traits, the level of the person's emotional literacy, and so on. It is well-known in general emotion research that for example language (Lindquist et al., 2016), culture (Mesquita et al., 2016), and various social factors (Fischer and Manstead, 2016) shape people's emotions and their descriptions of them.

Because of all this difficulty, a full systematic review of previous research was regrettably not possible yet. Semi-structural review methods have been recommended for topics such as this, where many disciplines are involved and the sources differ from each other (Snyder, 2019). This initial study aims to provide resources for future research which could use systematic review methodology and for example double coding of emotion words together with meta-analyses. As part of the semi-structural review procedure, it was decided that studies which discuss at least five different climate emotions with at least some empirical support were given special emphasis. As will be seen below, the climate emotion words in these sources were collected to **Table 1**, together with a brief description of those sources.

More specifically, the research procedure was as follows. First, previous research about climate emotions and especially the taxonomies or lists of them was reviewed. Database searches were made with relevant keywords such as climate + emotion/feeling/affect, and climate + various emotion words such as anger or anxiety. The emotion words which were used in searches were picked up from earlier research, such as Landmann's (2020) categorization and major surveys (Smith and Leiserowitz, 2014; Hyry, 2019). Relevant studies had also been gathered over the years as part of the research profession of the author.

The amount of possible source material was immense. The emotion words found in the studies were collected and compared. Key sources were gathered into **Table 1**, and many sources which were used in support of the discussion are mentioned below in section Climate Emotions in Previous Research, categorized under research fields and topics. The key sources are peer-reviewed articles published in academic journals, dissertations and science-based reports. One preprint (Marczak et al., 2021) was included because it directly studies climate emotions, but the results are not based on this preprint. The secondary sources consists of texts which discuss one or many climate emotions, but less than five, and the amount of empirical support in these texts varies. The secondary sources mainly include peer-reviewed research, but also science-informed books about climate emotions.

Second, after the literature reviews, their results were compared with earlier taxonomies of eco-emotions, especially Landmann's (2020), and also with general emotion theory (Barrett et al., 2016). An initial taxonomy of prominent or potentially prominent climate emotions was then constructed, and its results are seen in **Table 2**. Examples of sources which discuss those emotions were marked into the table: a full table including all the mentions of those emotions is a possible topic for future research. If a certain emotion seemed to be important in relation to the climate crisis, based on general emotion theory or general scholarship about eco-emotions, but that emotion was missing from the climate emotion research which was reviewed, then that emotion was included in the taxonomy, with a reference to general sources which discuss that emotion.

The author is aware that there may be many kinds of subjectivity and researcher bias in this kind of methodology. A strident effort was made to construct the taxonomy as carefully as possible, but future research with full systematic review methodology should review the initial taxonomy. The urgency of the topic and the preliminary character of this research are once more emphasized: the aim is that this research helps further research and practice, even though there are evident limitations. On a whole, however, emotion research is a difficult subject, and there is much disagreement altogether about taxonomies that various scholars have produced (Scarantino, 2016). It is difficult to avoid all subjectivity in relation to this research area, and at least one's discipline strongly influences one's selections.

Third, the taxonomy was discussed in relation to interdisciplinary research, and emotion words were grouped together in this discussion. This grouping is not intended to be any strict categorization: it simply shows connections between various emotions and enables discussion about them. Certain emotion words which were not much discussed in previous research are mentioned here, bringing more tones to the climate emotions. This discussion is, broadly defined, philosophical in nature, although it does not manifest any single philosophical stance. It has characteristics of a narrative review: it delineates trends in what has been researched and what has not. A few existing, broad surveys of climate emotions are used as references to the existence of many of these climate emotions (especially Hyry, 2019; Hickman et al., 2021), but it was not possible in this research to evaluate the prevalence or statistics related to these emotions. It seems evident that there is some overlap between some of the words that researchers use. A nuanced study about those meanings would include difficult theoretical work about definitions of emotions and their relations with each other, which is a subject for future research.

RESULTS

Climate Emotions in Previous Research

Numerous research articles and books were found which discuss climate emotions either by the term emotion, feeling or affect. Of this vast material, 14 studies which discuss at least five different climate emotions with at least some empirical support were chosen as major sources. These sources can be divided into two subgroups: first, peer-reviewed studies which discuss many different climate emotions on the basis of empirical observations (Ojala, 2012a; Cunsolo Willox et al., 2013; Kleres and Wettergren, 2017; Verlie, 2019; Hamilton, 2020; Jovarauskaite and Böhm, 2020; Martiskainen et al., 2020; Verlie et al., 2020; Hiser and Lynch, 2021), and second, published surveys which have explored self-reports of many climate

TABLE 2 | An initial taxonomy of climate emotions and certain closely related mental states.

Emotions and mental states	Examples of sources about this emotion as a climate emotion	Examples of sources about this emotion as an eco-emotion	Other emotion research sources (only included if no other sources)	Included in Landmann's (2020) taxonomy
Surprise-related emotions				
Amazement, awe, wonder	Sezen-Barrie et al., 2020	McShane, 2018; Zhao et al., 2018; Landmann, 2020		x
Surprise	Caillaud et al., 2019	Böhm, 2003		
Disappointment	Jovarauskaite and Böhm, 2020; Hiser and Lynch, 2021			
Confusion	Stoknes, 2015 [Marczak et al., 2021]	Lertzman, 2015		
Feeling disoriented, upset, troubled, disturbed	Cunsolo Willox et al., 2013; Hamilton, 2020			
Shock and trauma	White, 2015; Woodbury, 2019; Kaplan, 2020; Susteren and Al-Delaimy, 2020	Pihkala, 2020c		
Feeling isolated	Ojala, 2012a; Kretz, 2017; Verlie et al., 2020			
Threat-related emotions				
Fear	Caillaud et al., 2019; Hickman et al., 2021			x
Worry	Ojala, 2012a; Cunsolo Willox et al., 2013			
Anxiety (in milder forms)	Martiskainen et al., 2020; Hickman et al., 2021			x
Dread	Clark, 2020; Haltinner et al., 2021			
Helplessness/powerlessness (in mild or moderate amounts)	Smith and Leiserowitz, 2014; Hickman et al., 2021			
Feeling overwhelmed (in mild or moderate amounts)	Verlie, 2019; Verlie et al., 2020			
Terror, panic	Hiser and Lynch, 2021 [Marczak et al., 2021]			
Sadness-related emotions				
Sadness	Hyry, 2019; Hickman et al., 2021			
Grief	Hyry, 2019; Hickman et al., 2021			
Solastalgia	Cunsolo Willox and Landman, 2017; Albrecht, 2019			
Yearning	Randall, 2009; Comtesse et al., 2021			
Longing	Randall, 2009; Comtesse et al., 2021			
Feeling "blue," feeling "low"	Hyry, 2019 [Marczak et al., 2021]			
Feeling lonely	Kretz, 2017; Verlie et al., 2020			
Strong anxiety-related feelings				
Strong anxiety	Hyry, 2019; Hickman, 2020			
Helplessness, powerlessness (feeling these strongly)	Hickman, 2020; Budziszewska and Jonsson, 2021			
Feeling strongly overwhelmed	Lewis et al., 2020; Verlie, 2022			
Strong depression-related feelings				
Strong depression	Berry et al., 2018; Hyry, 2019			
Feeling meaninglessness	Budziszewska and Jonsson, 2021			
Hopelessness	Jovarauskaite and Böhm, 2020; Martiskainen et al., 2020			x
Feeling numb	Lifton, 2017; Martiskainen et al., 2020			
Emotions closely related to guilt and shame				
Guilt	Smith and Leiserowitz, 2014; Hyry, 2019; Hickman et al., 2021			x
Shame	Hyry, 2019; Hickman et al., 2021; Hiser and Lynch, 2021			x
Embarrassment	Caillaud et al., 2019			x
Feeling inadequate	Hyry, 2019			
Regret	Jovarauskaite and Böhm, 2020			
Remorse	Hyry, 2019			

(Continued)

TABLE 2 | Continued

Emotions and mental states	Examples of sources about this emotion as a climate emotion	Examples of sources about this emotion as an eco-emotion	Other emotion research sources (only included if no other sources)	Included in Landmann's (2020) taxonomy
Emotions related to indignation				
Indignation, moral outrage	Caillaud et al., 2019; Jovarauskaite and Böhm, 2020			
Feeling betrayed	Hickman et al., 2021; Jones and Davison, 2021			
Disgust-related emotions				
Disgust	Smith and Leiserowitz, 2014; Minor et al., 2019			x
Aversion	Hyry, 2019	O'Dell-Chaib, 2019 (dissertation)		
Resentment	Andrews and Hoggett, 2019; Verlie et al., 2020			
Anger-related emotions				
Anger	Hyry, 2019; Hickman et al., 2021			x
Rage	Hyry, 2019 [Marczak et al., 2021]			
Frustration	Hyry, 2019; Verlie, 2019			
Feeling irritated	Hyry, 2019 [Marczak et al., 2021]			
Envy-related emotions				
Envy	No	McGrath et al., 2018	Sabini and Silver, 2005; Lewis, 2016a	
Jealousy	No	McGrath et al., 2018	Sabini and Silver, 2005; Lewis, 2016b	
Admiration	No	Landmann, 2020	Fischer and Manstead, 2016; Lomas, 2016	x
Feelings of hostility				
Contempt	Jovarauskaite and Böhm, 2020			x
Feeling skepticism, doubt	Hyry, 2019 [Marczak et al., 2021]			
Feeling bored	Hyry, 2019; Verlie et al., 2020			
Schadenfreude	[Unpublished research manuscript on "partisan schadenfreude" in relation to climate change: Webster et al., 2021]; brief reflections in Cox et al., 2018		Fischer and Manstead, 2016	
Many kinds of positive emotions				
Interest	Smith and Leiserowitz, 2014; Hyry, 2019			
Feeling an urge to do something good	Hyry, 2019 [Marczak et al., 2021]; Hoggett and Randall, 2018	Lertzman, 2015;		
Feeling motivated	Kleres and Wettergren, 2017; Hamilton, 2020			
Excitement	Hoggett and Randall, 2018; Hyry, 2019			
Empowerment	Hoggett and Randall, 2018; Hamilton, 2020			
Feeling of being moved	Stollberg and Jonas, 2021	Landmann, 2020		x
Feeling determined	Hamilton, 2020; Verplanken et al., 2020			
Joy, pleasure, happiness	Ojala, 2012a; Minor et al., 2019; Pickard et al., 2020			x
Elevation	No	Landmann, 2020		x
Amusement	No	Landmann, 2020		x
Pride	Bamberg et al., 2018	Adams et al., 2020; Landmann, 2020		x
Gratitude	Hamilton, 2020 [Marczak et al., 2021]	Macy and Brown, 2014		
Hope	Smith and Leiserowitz, 2014; Minor et al., 2019			
Optimism	Hamilton, 2020; Hickman et al., 2021			
Togetherness, belonging	Pipher, 2013; Pickard et al., 2020	Hoggett and Randall, 2018		
Love	Gillespie, 2020; Hamilton, 2020			x
Care	Cunsolo Willox and Landman, 2017; Jensen, 2019			
Empathy	Caillaud et al., 2019; Hamilton, 2020			x
Sympathy	Jovarauskaite and Böhm, 2020			
Compassion	Hamilton, 2020; Ray, 2020	Landmann, 2020		x

If there is no source available about this emotion as a climate emotion, then (a) other eco-emotion studies or (b) general emotion studies are mentioned as sources. Only a couple of sources are mentioned for each emotion, and emphasis has been given on studies and surveys with a large number of respondents/subjects. The few preprints that have been included are marked with [brackets].

emotions (Smith and Leiserowitz, 2014; Caillaud et al., 2019; Hyry, 2019; Minor et al., 2019; Hickman et al., 2021). Several of these studies were conducted either under environmental psychology or environmental education. One preprint was included as a supporting source (Marczak et al., 2021) because it directly discusses a wide array of climate emotions, but the results were not based on this unpublished research.

It was found that many studies include discussion of affective phenomena which are not exactly emotions but can include many emotions, such as stronger anxiety, depression, shock, and panic. These and certain others, such as feeling numb, are here called *mental states*. It was difficult to pick a name for these phenomena, since they are multifaceted. Some of them may include mental health disturbance, but they are not only that. While the concept of mental state is also used in various disciplines in various connotations (see Goldman, 2006), it is here used simply to refer to these emotion-related phenomena which are not exactly emotions, at least not only. This complex dynamic is evident for example in relation to various forms and formulations of "climate anxiety" and "climate depression" (Pihkala, 2020a). One may feel anxiety and depressive feelings in an emotion-like manner, but these concepts also refer to the wider phenomena of anxiety and depression. In relation to several sources, it was sometimes difficult to tell which connotation(s) the author(s) had in mind.

Table 1 depicts these 14 important sources and the supplementary preprint (Marczak et al., 2021). It includes information about their subject, method, and the emotions and/or mental states discussed prominently in them.

Important secondary source material was found in several disciplines and research areas. This material was used in conceptualization of the proposed initial taxonomy of prominent climate emotions and in the interdisciplinary discussion:

- Earlier research about taxonomies of environmentally relevant emotions (Landmann, 2020).
- Studies which have discussed some climate emotions as part of their focus on climate anxiety and/or eco-anxiety (Kelly, 2017; Hickman, 2020; Pihkala, 2020a,b; Verplanken et al., 2020; Budziszewska and Jonsson, 2021; Marczak et al., 2021; Stanley et al., 2021).
- Studies which focus on specific climate emotions, such as climate grief (e.g., Randall, 2009; Cunsolo Willox and Landman, 2017; Cunsolo Willox and Ellis, 2018), solastalgia (for overviews, see Albrecht, 2019; Galway et al., 2019); ecological guilt (e.g., Jensen, 2019; Adams et al., 2020), eco-pride (e.g., Bissing-Olson et al., 2016), climate anger (Kleres and Wettergren, 2017; du Bray et al., 2019), and climate hope (e.g., Ojala, 2012b, 2017; Bury et al., 2020). Terminology about these emotions varies, and often the formulations of "ecological X" or "eco-X," with X referring to a certain emotion, are used. Some of these studies focus on several climate emotions, some only on one.
- Scholarship in various disciplines about people's affective responses to climate crisis, such as environmental psychology (e.g., van der Linden, 2017; Nabi et al., 2018; Wang et al., 2018); human geography (e.g., Head, 2016; Head and Harada, 2017; Kemkes and Akerman, 2019), psychosocial studies (e.g., Weintrobe, 2013; Lertzman, 2015; Hoggett, 2019), environmental communication and adaptation studies (e.g., Moser, 2013), education or youth studies (e.g., Nairn, 2019; Jones and Davison, 2021), affect research (Bladow and Ladino, 2018a; Bristow, 2019), environmental philosophy (e.g., Antadze, 2020; McQueen, 2021), and environmental education (e.g., Ojala, 2013, 2016; Bryan, 2020; Pihkala, 2020b; Verlie, 2022). General studies about emotions related to environmental issues were also consulted (Böhm, 2003; Kals and Müller, 2012; Gonzáles-Hidalgo and Zografos, 2020).

When pondering about potential climate emotions which have not been much studied yet, the general literature about emotion theory was used (e.g., Frijda, 1986; Goldie, 2010; Barrett et al., 2016; Lomas, 2016; Scarantino and de Sousa, 2018), in addition to the interdisciplinary literature about environmental issues which touches upon emotions, which was mentioned above.

The Initial Taxonomy of Climate Emotions

The selection of which emotions would be included in the taxonomy was partly a difficult one. Many different climate emotions were mentioned in the studies. However, some prominent eco-emotions and moral emotions were either omitted or very little discussed. The selection that was made was informed by an analysis of a large amount of related research, but it is clear that other choices could also have been made, especially in relation to which nuances of various emotions were included.

However, the selection of some climate emotions was easy, because they were discussed in almost all of the most relevant studies. These are fear/worry/anxiety, sadness/grief, guilt/shame, and hope/empowerment. Most studies also featured some discussion of anger or frustration. Several studies mentioned nuances or related forms of several of these emotions, such as feeling helpless or feeling embarrassed. Interestingly, when the array of these very commonly discussed climate emotions is compared with theories of basic emotions, it can be discerned that these are many similarities (see Tracy and Randles, 2011). However, surprise, disgust and contempt have received more attention in basic emotion theories, as well as in several studies about eco-emotions in general. These emotions were included in the taxonomy and their role as climate emotions is briefly discussed in the Discussion.

All the environmentally relevant emotions proposed by Landmann (2020) were either found in climate emotion research or then added to the taxonomy. However, key sources about climate emotions testified to the common existence of several other climate emotions. Since the climate crisis is a moral issue, it is logical that there are many moral emotions in relation to it. For example, there are feelings of disappointment, moral outrage and desire to act. Furthermore, there are various hostile emotions toward people who manifest different climate opinions on related moral issues.

There is various vocabulary about feelings of togetherness and belonging. Because this emotional dimension seems to feature prominently for example in climate activism, these emotion words were added. Envy and jealousy are very common emotions

(Frijda, 1986; Goldie, 2010; Barrett et al., 2016) and while discussion about them was not found in climate emotion sources or eco-emotion sources, they were added to the taxonomy. There has also been critical discussion about the omission of them from theories of basic emotions: for example, both Plutchik and Ekman did not include envy/jealousy in their models (e.g., Sabini and Silver, 2005).

Several mental states were selected to be included: shock, trauma, strong anxiety, and strong depression. There were two main reasons for this. First, these mental states feature prominently in climate emotion research, and second, their manifestations often include many climate emotions. It should be mentioned that the concept of stress featured also quite prominently in studies.

The taxonomy is seen in **Table 2**.

DISCUSSION

In this Discussion section, the selected emotions will be discussed in relation to several issues. Their basic character as climate emotions or mental states is briefly discussed, and relevant research is introduced. Issues related to morality and pro-environmental behavior are mentioned, but space limits do not allow full discussions of these wide topics. Since the range of emotions included in this article is so broad, it has naturally been impossible to cite all relevant studies on each of them.

The proceeding of the discussion and the manner of grouping the emotions together is as follows. Surprise-related emotions, including amazement, and disappointment, are grouped into section Amazement, Surprise, Disappointment, Confusion. Because shock, trauma, and feeling isolated can be closely related to this phase of encountering climate issues, they are discussed next in section Shock, Trauma, Feeling Isolated. Fear- and anxiety-related emotions are grouped into section Fear, Worry, Anxiety, Powerlessness, Dread, including worry, powerlessness, helplessness, and dread. Sadness-related emotions are discussed in section Sadness, Grief, Yearning, Solastalgia, including solastalgia, a special kind of ecological grief/sadness. Strong anxiety and strong depression are separated into their own section in section Strong Anxiety, Depression, Despair. Guilt and shame, complemented with feelings of inadequacy, are grouped into section Guilt, Shame, Feeling Inadequate, Regret, together with embarrassment and regret. The emotions related to moral outrage and disgust are given their own emphasis in section Feeling Betrayed, Disillusion, Disgust, separated from more general reflections on anger and rage in section Anger, Rage, Frustration. In section Hostility, Contempt, Feeling Discontent, Aversion, envy is discussed, because it seems to feature in climate matters, even though there is of yet little research about it. While anger and disgust were already discussed earlier, the hostile emotions which include elements of them are given special attention in section Envy, Jealousy, Admiration. These include contempt, feeling discontent, aversion, and schadenfreude (feeling pleasure when something bad happens to someone else). Finally, in sections Motivation, Urge to Act, Determination, Pleasure, Joy, Pride, Hope, Optimism, Empowerment, Belonging, Togetherness, Connection, and Love, Empathy, Caring, Compassion, many positive emotions are grouped together: ones related to motivation, determination and an urge to act (section: Motivation, Urge to Act, Determination), pleasure, joy, and pride (section: Pleasure, Joy, Pride), hope and empowerment (section: Hope, Optimism, Empowerment), feelings of belonging (section: Belonging, Togetherness, Connection), and feelings of love and care (section Love, Empathy, Caring, Compassion).

Certain general observations are in order about these emotions and the ways in which they are grouped together here.

In relation to ways of grouping them together, it should be noted that there are several ways in which that can be done. One option would be to apply some of the categorizations which are used in previous research. For an example of this, see Landmann's (2020) categorization of many important ecological emotions/feelings into Self-condemning, Other-condemning, Self-praising, Other-praising, Other-suffering, Threat-related, and Hedonistic emotions. However, it was felt that these categorizations would not capture all the aspects of the climate emotions which were deemed important in the analysis. In addition, there are complex issues related to the directionality of emotions as self- or other-directed. It seems that in many cases, a particular emotion can be predominantly self- or other-directed, but not solely so; for example, there is both self-oriented anger and other-oriented anger. Furthermore, there are collective forms of many emotions, such as collective guilt, which further complicates the categorization of emotions into simply self- or other-oriented. And finally, the issues related to valence are complex (for wider reflections on these dynamics of emotions, see Solomon and Stone, 2002; Bamberg et al., 2018; Bellocchi and Turner, 2019).

As a result of these complexities, it was decided that the grouping was to be done simply on the basis of (a) closeness between emotions and (b) technical reasons, the latter meaning that there is a suitable number of subchapters in this section; it was not deemed reasonable or even possible to discuss each emotion separately. This grouping aims to help researchers and readers from various fields to better grasp the variety of climate emotions.

It should be emphasized that the taxonomy does not reflect any balance in occurrence of these emotions and mental states. There is not enough research available to make any fuller estimations of the prevalence and commonality of these various emotions, and manifold contextual factors shape their occurrence and even the names that emotions are given. Some emotions do seem to be relatively common in the groups and countries that have been studied, such as sadness and fear, but further research is needed. There are many gaps in current research; for example, there is relatively much research evidence of strong forms of climate grief, while there is much less research about climate shame, even though many studies and public discussions point strongly to the existence of that. The initial taxonomy which is produced in this article will hopefully help, for its part, future research to further explore many related dynamics.

The intensities of these emotions may also differ. Some note of this has been made in the discussion: strong feelings

of helplessness and powerlessness are discussed together with strong anxiety and strong depression (section: Strong Anxiety, Depression, Despair), while milder forms of these emotions are discussed in connection with other threat-related emotions (section: Fear, Worry, Anxiety, Powerlessness, Dread). Involved are difficult discussions about whether some of the emotions in the taxonomy are simply different forms of certain emotions, and there are many different views about those questions in emotion research.

Another issue to note is the temporal dimension. Some of these emotions are typically experienced for a brief time, while some others are more akin to long-term moods. A clear example is the way in which shorter anxiety is situated in the group of threat-related emotions, while stronger anxiety is situated together with strong depression, another longer-lasting phenomenon. Many of the emotions mentioned here can manifest in various temporalities, and naturally the embodied experiences of them may also differ.

It would seem to be typical for climate emotions that they manifest together with various other emotions, in a plurality of compositions (for the general phenomenon of experiencing multiple emotions at a time, see Lewis, 2016a, p. 277). This complexity and the question of which climate emotions may often produce combinations must be left for future research. For example, many scholars have pointed out that climate grief and climate guilt tend to manifest together, at least in affluent societies (e.g., Jensen, 2019; Pihkala, 2020b; Marczak et al., 2021).

Finally, it should be mentioned that no balance has been sought in the array between what are commonly called positive emotions and negative emotions. Many emotions which have been traditionally situated in either category are included here. Insightful observations of the complexities of such categorizations and the uses of the concept of valence have been made (Solomon and Stone, 2002; Bellocchi and Turner, 2019), and this article does not engage further in those discussions.

Amazement, Surprise, Disappointment, Confusion

Amazement and surprise have both been suggested to be primary or basic emotions, which have universality and easily perceived facial expressions (Scarantino, 2016). Disappointment is closely tied with these emotions, resulting from a negatively perceived surprise or other stimulus (Craib, 1994); one might also use such terms as chagrin or feeling aghast, astonished or astounded. Closely linked with amazement and surprise, people have often been found to feel confusion about climate change and the required behavior (e.g., Lertzman, 2015; Stoknes, 2015). Confusion often contributes to experiences of anxiety, where one wonders about what would be the best response to a felt threat which includes uncertainty (see sections Fear, Worry, Anxiety, Powerlessness, Dread and Strong Anxiety, Depression, Despair below). Sezen-Barrie et al. (2020) have studied the role of wondering as part of the emotional and cognitive reactions toward climate change.

Especially confusion and disappointment as related to climate matters have been discussed in studies, but in addition, there are numerous implicit depictions of these various surprise-related emotions in studies about ecological issues. People tell of the amazement they have felt when they have received information about how bad the ecological crises are, both globally and locally (e.g., the implicit discussion of amazement about climate crisis in Hoggett and Randall, 2018). Since these stimuli are problem-related, they lead to negatively valenced feelings of amazement and surprise; in other words, to disappointments, shocks, and disgust-related responses (Böhm, 2003). A telling example is the array of negative emotions and feelings felt by the Irish people whose coastline is eroding because of climate change (Phillips and Murphy, 2021).

These responses are often intimately related to moral outrage or indignation, which are discussed below in section Feeling Betrayed, Disillusion, Disgust. However, there are also positively valenced experiences of "eco-amazement:" surprises related to ecological recovery or social progress related to environmental politics. These are closely connected with feelings of pleasure and sometimes also with pride, if the person feels somehow part of the developments which are deemed good (see section Pleasure, Joy, Pride below). In addition, there are the feelings of amazement, awe, and wonder in people's experiences of environments, which have received much attention in fields such as environmental aesthetics, environmental education, and environmental psychology (see e.g., Houser, 2014, Chapter 3; McShane, 2018; Zhao et al., 2018), but this is not the place to discuss these further.

Shock, Trauma, Feeling Isolated

Shock and trauma are mental states which can include many emotions, but also numbness. Because the ecological crisis is so vast and devastating, many people have been feeling shocked by it. There are naturally various intensities of these shocks. Some of them remain more manageable, while in other cases some of them can lead to difficult processes of stronger trauma. These mental states are closely related to grief processes, but a differentiation should be made between various forms of climate grief, because not all processes of climate sadness include as much trauma. Grief and sadness are discussed below in Sadness, Grief, Yearning, Solastalgia.

There is a burgeoning research interest about "climate trauma" (White, 2015), and several different connotations of trauma have been probed in this context. First, there are the more easily measured trauma effects of events which are related to the climate crisis. For example, the Post-traumatic stress disorder (PTSD) impacts of climate change -influenced natural disasters have been studied (Chen et al., 2020). These can include for example many feelings of anger and despair. Second, there are the indirect traumatic impacts of the climate crisis, which can be studied with the frameworks of secondary trauma and vicarious trauma (Pihkala, 2020c). Third, even more widely, there are the ambient impacts of the climate crisis, which cause traumatic stress to the amount that several terms have been proposed to capture the effects, such as "pre-traumatic stress" (Kaplan, 2020; Susteren and Al-Delaimy, 2020) or "mid-traumatic stress" (Pipher, 2013). The concept and phenomenon of climate anxiety is closely related to this (Clayton, 2020; Pihkala, 2020a). Furthermore,

ecopsychologists have argued that there is a kind of primary, cultural-level trauma, which has resulted from the breaking and damaging of the connection between humans and the more-than-human world (Glendinning, 1994/2007). This has been linked with climate trauma by Woodbury (2019), who has argued that a new kind of understanding about levels of trauma are needed to capture the magnitude of "climate trauma."

There are many ways in which one can feel lonely or even isolated because of the climate crisis. One may feel isolated if one's community does not recognize the validity of difficult climate feelings or climate action (Kretz, 2017). Theoretically it is also possible that one may feel lonely and isolated if one is skeptical about climate matters and others in one's community are not. Strong experiences of trauma are known to be sometimes linked with self-isolating behaviors, as are stronger depression and stronger anxiety. For discussion about the dynamics of self-isolation in relation to climate trauma, see White (2015).

When analyzing varieties of climate trauma in depth, it becomes evident that many emotions can be connected with its forms, such as grief, anxiety, guilt, and anger. There is strong dimension of sadness in trauma and loneliness, for example, and threat-related emotions are very commonly present.

Fear, Worry, Anxiety, Powerlessness, Dread

These emotions, which are related to threat and risk perceptions, exist in numerous different intensities and modalities. There is also a vast body of scholarly literature about various definitions related to them. In the following, some instances of them are briefly discussed. They are linked with feelings of insecurity, and the climate crisis seems to often threaten people's sense of safety, which is a central psychological need.

People feel climate fear: bodily—or, bodymindly—reactions engendered by the climate crisis. As the philosopher McQueen (2021) points out, fear has fundamentally a life-protecting function, but naturally fear can easily go astray by becoming too intense or by arising in situations where it is not needed. The same dynamics apply to anxiety, and it should be noted that sources often use these two concepts in intermingled ways (Pihkala, 2020a). There evidently are strong forms of eco-fear and climate fear: people sometimes feel panic, terror, or hysteria in relation to ecological threats, but most forms of eco-fear seem to be less intense. For example, in a Finnish national survey, 31% of Finns recognized some kind of climate fear in themselves, 25% self-recognized anxiety, and <10% recognized strong climate anxiety symptoms (Hyry, 2019). In a recent global survey about young people and climate change, 67% of the ten thousand respondents reported feeling climate fear and 62% climate anxiety of some kind (Hickman et al., 2021).

People feel climate worry in various ways, and there seems to be a need for further discussion about making distinctions between worry-related phenomena (see Ojala et al., 2021). Stewart (2021), who has developed a scale for climate change worry, defines it as "primarily verbal-linguistic thoughts about the changes that may occur in the climate system and the possible effects of these changes." Often types of worry are differentiated into constructive and unconstructive or pathological worry: in the former, functioning is maintained, but in the latter, worry—usually in the form of strong rumination—becomes paralyzing (Ojala et al., 2021).

The burgeoning research on "climate anxiety" actually studies many different anxiety-related issues, including worry and rumination. Feelings and emotions which commonly manifest in connection with climate anxiety include fear, grief, and guilt (Clayton and Karazsia, 2020; Cunsolo et al., 2020; Pihkala, 2020b). Furthermore, there are evidently various levels of anxiety, ranging from strong anxiety to those emotion-like manifestations of anxiety which help individuals to react to threats. Pihkala (2020a) has applied emotion researcher Kurth's (2018) concept of "practical anxiety" to describe this beneficial dimension of eco-anxiety and climate anxiety. Research is only gradually moving forward, but forms of both constructive anxiety and paralyzing anxiety have been found in studies. However, most scholars argue that as a whole, eco-anxiety and climate anxiety should not be seen fundamentally as anxiety disorders but instead as wide phenomena which include many motivational aspects (Clayton, 2020; Hickman, 2020; Verplanken et al., 2020; Wullenkord et al., 2021). Hogg et al. (2021) draw from the distinctions between various forms of rumination made by Olatunji et al. (2013), and point out that in addition to cognitive-emotional impairment, which is targeted by Clayton and Karazsia's (2020). Climate Anxiety Scale, emotion-driven rumination should be studied in relation to eco-anxiety (see also Wullenkord et al., 2021).

Feelings of ambivalence, powerlessness and helplessness seem to be especially common features of eco-anxiety, which is logical given that anxiety in general is characterized strongly by feelings of uncontrollability, unpredictability, and uncertainty (Pihkala, 2020a). More intense forms of these feelings are discussed below in the section about Strong anxiety, depression, and despair (4.5). In a Finnish national survey about climate emotions, powerlessness was recognized by 39% of the respondents and feeling paralyzed by 12% (Hyry, 2019). In a recent global study, 56% of the young respondents felt powerlessness and 51% helplessness in relation to climate change (Hickman et al., 2021).

People have also been noted to sometimes feel strong climate-related fear and worry, bordering on terror, which is often called dread and at times horror. Albrecht (2019) has coined the term "global dread" to describe this, and Clark (2020) contrasts a more universal "Anthropocene Horror" with ecological grief related to more specific losses. In more empirical research, Haltinner et al. (2021) studied worry and dread among climate change skeptics, linking worries with more specific objects and dread with "bigger, more existential threats" (p. 3).

Worry includes both cognitive elements, such as repetitive and at least partly uncontrollable chains of thoughts and images, and an affective dimension of feeling troubled (Verplanken et al., 2020; Stewart, 2021). One facet of this affective dimension of worry, which could be explored more, is its link with caring. For example, when people say that they feel worried about their children's futures because of the climate crisis, this does not mean just repetitive cognitive phenomena, but feelings of care and concern. This links worry, anxiety, and fear with love and compassion, which are discussed below in section Love, Empathy, Caring, Compassion, but also with sadness.

Sadness, Grief, Yearning, Solastalgia

There are many shades in sadness and grief, ranging from mild sadness to bereavement-like, forceful grief. There are also many ways in which related concepts are used: many refer to sadness as a basic emotion and to grief as a more intense and often longer feeling or mood. Sadness is one of the most studied dimensions of eco-emotions and climate feelings, which seems to reflect the prominence of grief among the affective responses to ecological crises. The character of climatic changes is such that there are (1) numerous kinds of losses involved, (2) many of the losses are very strong, and (3) there has been a lack of psychosocial resources to encounter these kind of losses. As a result, there has been manifold forms of climate loss and sadness, often in complicated forms (Tschakert et al., 2019). The most common general terms for these are "ecological grief" (Cunsolo Willox and Landman, 2017) and "climate grief" (Cunsolo Willox and Ellis, 2018), but "climate sadness" has also been explored (Pihkala, 2020d).

While there is a significant body of research about ecological grief, there is less scholarship yet about models which would show its various forms. Cunsolo Willox and Ellis (2018) discuss insightfully many aspects of climate grief, applying terminology from grief theories, such as disenfranchised grief, ambiguous loss, and frozen grief. In her influential article, Randall (2009) applied grief researcher William Worden's thinking into ecological grief. Acute losses, transitional losses, anticipatory losses and chosen losses all engender slightly different kinds of grief and sadness. Lertzman (2015) has championed the term environmental melancholia, which refers to a difficult form of mourning where the causes are not necessarily detected by the persons themselves. All this being said, there is still need for further discussion and model-building about various forms and intensities of ecological grief and its crucial part, climate grief (similarly Comtesse et al. (2021)).

In those surveys where climate sadness or grief has been included, it has received rather high self-recognition scores among climate emotions. In a Finnish national survey, some kind of climate sadness was self-recognized by 34% of Finns (Hyry, 2019). The Finnish language does not differentiate between sadness and grief, but "alakuloisuus," which means a kind of melancholy or low mood, was inquired about in the survey, and 23% self-reported that. In an American survey (Smith and Leiserowitz, 2014), feeling "sad" was reported by 43%. In a Greenlandic survey (Minor et al., 2019), 7% felt sad very strongly, 12% moderately, and 27% not very strongly. Caillaud et al. (2019) observed significant levels of collective climate sadness both in France and Germany, but more in the former. In a global study in 2021, 67% of the young respondents recognized feeling sad because of climate change and 42% grief. 39% reported "feeling depressed" (Hickman et al., 2021); this is presumably more like an emotion or mood than a strong state of depression, and further research is warranted to explore varieties of climate depression (see section Strong Anxiety, Depression, Despair below).

A special word for certain forms of ecological grief is solastalgia, a term developed by environmental philosopher Albrecht to describe the felt sense of disturbance and sadness because of negatively perceived environmental changes. Albrecht himself has started to use the term in the general sense of ecological grief (Albrecht, 2019), but many scholars differentiate between various forms of ecological grief and use solastalgia to refer to place-related ecological sadness and longing. There is a burgeoning research interest in solastalgia, with many case studies from various parts of the world (for a review, see Galway et al., 2019). The "solastalgic distress" explored by Weik von Mossner (2018) comes close to what certain others have called eco-anxiety.

Yearning and longing are common parts in grief and sadness, and scholars have observed these in relation to climate grief and sadness, too. Longing can be directed both toward the past and the future: one may long for something that has gone, but also for something to come in the future. This provides certain links to hoping.

Recently, Comtesse et al. (2021) discussed the state of scholarship on climate grief and called for instruments to measure its forms. This is an understandable plea, but the issue is very complex, because there are so many different forms of climate sadness. In the health system, there have been certain tendencies to sometimes pathologize normal forms of sadness, as has been argued forcefully by Horwitz and Wakefield (2007). Measures and scales related to ecological grief and more specifically climate grief should take into account the fact that during the following years, there will be many kinds of ecological sadness and grief, and only some of these will sometimes fulfill diagnostic criteria. There are also milder forms of feeling "blue" or "low."

Strong Anxiety, Depression, Despair

Like shock and trauma, strong anxiety, and strong depression are mental states which can include many kinds of emotions. The wording strong anxiety is used here to differentiate between (1) practical anxiety and (2) stronger anxiety states and stronger trait anxiety. Research on the dynamics of eco-anxiety is currently ongoing, but the observations so far show that in general, eco-anxiety does not correlate strongly with general trait anxiety. In other words, persons who normally are not prone to anxiety still may experience eco-anxiety (Pihkala, 2020a; Verplanken et al., 2020; Hogg et al., 2021; Wullenkord et al., 2021; cf. Clayton and Karazsia, 2020).

Emotions that can manifest in connection to anxiety include feeling disturbed, feeling distressed, feeling helpless, and feeling hyperactive. In stronger anxiety, these feelings are more intense and longer-lasting. Strong anxiety can manifest as a feeling that the person just can't take it: a fearful feeling that one may collapse. As seen above in **Table 1**, feelings of overwhelm have often been reported in relation to the climate crisis. Some forms of eco-anxiety are captured by the preliminary definition of eco-anxiety in an APA report, "chronic fear of environmental doom" (Clayton et al., 2017). A person may feel a strong urge to do something to reduce anxiety (see also section Motivation, Urge to Act, Determination), which may manifest as various degrees of compulsive behavior (Pihkala, 2020a).

There are many kinds of depression, and some of them are normal parts of grief processes. A separation between depressive

feelings and longer-time depression is in order. In stronger depression, there may be intense feelings of worthlessness, which link this with guilt and shame, and powerful despair. Closely related to depression is despair, another term which is used in various connotations. As a feeling, despair may manifest also as a strong motivation to act, and this is a different matter from despair as a mood, which is commonly part of depression. There are sporadic writings about "climate depression" and "eco-depression" (for a review, see Pihkala, 2020a), but these feelings and mental states should be studied more. In a recent global study, 44% of the young respondents told of feeling climate despair (Hickman et al., 2021).

The ecological crisis and the climate crisis can also result in a difficulty to feel. A seeming state of non-feeling, numbness, and apathy has been noticed by several scholars (see **Table 1**; and e.g., Verlie et al. (2020)). Lertzman (2015) offers a wide discussion of "environmental melancholia" and argues, echoing Joanna Macy (e.g., Macy and Brown, 2014), that there is "a myth of apathy:" behind that which seems apathy are many complex and often suppressed or repressed emotions. Several other scholars have also applied psychologist Lifton's theory of "psychic numbing" to explain this phenomenon (Nicholsen, 2002; Norgaard, 2011; Lifton, 2017): people may numb themselves if they feel that they are not able to withstand difficult emotions. This can be made worse by feelings of powerlessness. Furthermore, an existence of "climate anhedonia" in various intensities—an inability to enjoy—seems evident, but needs further study.

As seen above in **Table 1**, feelings of hopelessness have been recognized in several studies in relation to the climate crisis and the global ecological crisis. Therapists have observed feelings of meaninglessness in some of their clients who feel climate anxiety, testifying to the manifestations of eco-anxiety as deep existential anxiety (Lewis et al., 2020; Budziszewska and Jonsson, 2021). Anxiety of meaninglessness, a classical category in theories of existential anxiety (Yalom, 1980), seems to be a difficult and quite common form of eco-anxiety (Pihkala, 2020a). It is possible that sometimes people feel resignation: they have lost any faith in their opportunities to make an influence, and some people feel resignation in relation to the shortcomings of the whole contemporary civilization.

Closely related to eco-depression and climate depression—sometimes called climate blues in their milder forms—are feelings of low self-esteem and inadequacy (cf. Marczak et al., 2021). These are intertwined with an affective dimension of guilt and shame.

Guilt, Shame, Feeling Inadequate, Regret

In classic formulations, guilt is linked with doing something wrong and shame with being wrong in some way. In other words, guilt is more other-oriented, since it is related to what one has done or left undone to others, and shame is more self-oriented, since it regards the individual's felt sense of oneself. However, both of these complex emotions include intricate interplay of social factors and self-evaluations (e.g., Lewis, 2016b).

It has been noted in numerous studies that people have multifaceted feelings of guilt and responsibility in relation to environmental issues (for wide discussions, see Jensen, 2019; Fredericks, 2021). While "eco-shame" and climate shame have received less attention than eco-guilt and climate guilt, it seems evident that shame is much present in the affective landscapes of the ecological crisis (Orange, 2017; Aaltola, 2021). Landmann (2020) includes the category of "Self-condemning Emotions (Guilt, Shame, Embarrassment)" as one important dimension in ecological affect. This points once again to the importance of these emotions, although the collective forms of guilt and shame cause certain challenges to the term "self-condemning," as will be discussed below.

The array of climate guilt and shame can seemingly range from temporary feelings of embarrassment to long-term feelings of complicated guilt and shame (Orange, 2017). Guilt and shame can both be related also to group identities, and it has been noted that people may feel climate guilt and climate shame because they associate themselves with groups that they deem inadequate in relation to climate matters. "Species shame" is ecological shame felt simply because one belongs to a human race which one deems to be shamefully destructive toward the more-than-human world (Orange, 2017; Bamberg et al., 2018; Jensen, 2019; Aaltola, 2021).

In a recent global research, 50% of the young respondents told that they feel climate guilt, and 46% told that they feel "ashamed" because of climate change (Hickman et al., 2021). In the Finnish national climate emotions survey of 2019, 24% of the respondents self-recognized climate guilt and 18% self-recognized climate shame; in the youngest segment, 15–30-year-olds, the numbers were significantly higher, 31% for climate guilt and 26% for climate shame. In addition, 44% self-recognized "riittämättömyyden tunne," feeling inadequate because of the climate crisis (Hyry, 2019). This feeling seems to be significant form of the affective reactions to climate risk, and it is seemingly easier to self-admit and self-recognize than guilt or shame. Even without stronger feelings of guilt or shame, people feel to be inadequate because the demands posed by the climate crisis are so vast. This has been implicitly discussed by researchers such as Verlie (2019), but the emotion term of "feeling inadequate" may help to direct more attention to it: "on a daily basis, I feel like I'm not doing enough, I'm not achieving enough to create this huge impact I'm waiting for. Though I feel like I'm not doing enough, I don't know what else I can do" (Verlie, 2019, p. 4).

Furthermore, various forms of regret in relation to ecological issues have also been observed (Böhm, 2003; Jovarauskaite and Böhm, 2020). In the Finnish national survey, 16% self-recognized feelings of climate regret, and 26% of the youngest segment, the 15–30-year-olds (Hyry, 2019).

Feeling Betrayed, Disillusion, Disgust

Many emotions are put together here, but they have elementary connections with each other. These emotions are closely related to moral outrage and to anger in general, which will be discussed in the next subsection. A key unifying theme is a feeling of injustice, which causes resentment (for resentment and the climate crisis, see Andrews and Hoggett, 2019). Feelings of disappointment, which were discussed above in relation to amazement (section: Amazement, Surprise, Disappointment, Confusion), are much present here.

Analysis of studies reveals that these kind of emotions are very common and quite central in relation to the climate crisis and to many other ecological crises. Compared to their central role, there is relatively little explicit discussion of them. Several scholars have observed that some young people feel betrayed because of climate inaction by the decision-makers and partly by the earlier generations (Hickman, 2020; Jones and Davison, 2021). Psychoanalyst and author Weintrobe (2021) speaks strongly on the behalf of those who have been deceived by a "climate bubble," a culture where climate responsibility has been avoided. In a recent global study, 58% of the young respondents felt that the governments of the world had betrayed them in relation to climate action (Hickman et al., 2021).

Those who suffer from place-related environmental damage—see the discussion above about grief and solastalgia—often display feelings of being betrayed (e.g., Askland and Bunn, 2018, 19). On one hand, these are feelings of solastalgia, but they are often also climate emotions, because climate change is strongly affecting the local changes (Galway et al., 2019, 6). Feelings of disillusion have also been reported (e.g., Marczak et al., 2021).

Disgust is a feeling that seems to have been relatively little researched in relation to environmental issues. For example, Hiser and Lynch (2021) decided to replace Plutchik's emotional category of disgust with shame (p. 8). Exceptions include Böhm's (2003) influential study about various ecological issues and emotional responses to them, O'Dell-Chaib's (2019) dissertation about ecological affect, and the book about ecocriticism by Houser (2014), where a complete chapter is dedicated to discussing disgust. Houser mainly analyzes the novel *Infinite Jest* by David Foster Wallace in relation the dynamics connected to environmental disgust in that book, but she also provides wide-reaching observations about the emotion. Disgust strongly captures attention and is clearly present for example in bodily reactions to pollution. In many cases, disgust may provoke pro-environmental behavior: for example, people disgusted by plastic pollution in water and in animal bodies can be sparked into activities and policy support related to reduction of plastic waste. However, the dynamics are complex, as they usually are in relation to difficult emotions: disgust may also drive people away from anything that reminds them of the issue. Scholars have argued that in order for disgust to support long-term change, "pedagogy of disgust" (Lupton, 2015) is needed in communication (Henderson and Green, 2020).

In surveys, many people have been found to feel "disgusted" by climate change (Smith and Leiserowitz, 2014; Minor et al., 2019). It is somewhat difficult to evaluate the general valence of this climate disgust, because it can be estimated that some people are morally disgusted by the injustices of climate change and some people feel aversion toward the whole subject (see the discussion below in section Hostility, Contempt, Feeling Discontent, Aversion).

The topic of how disgust may feature in interpersonal relations in connection with ecological issues needs further research (see, however, Twine, 2010). Nussbaum (2018) has shown how disgust has been used in politics, often combined with misogyny. In environmental politics, it has been noted that the climate activist Greta Thunberg has been a target of serious misogyny (Jung et al., 2020; Keller, 2021), and the dynamics related to disgust should be studied in relation to this.

Anger, Rage, Frustration

Anger and rage are very closely connected with the emotions discussed in the previous subsection. In addition to just causes, anger can also arise from misconceptions of injustices. People may feel rage and fury because of narcissistic reasons, and as a psychological or psychosocial defense against felt threats to self and/or group identity. There does not exist an universally accepted exact terminology about various forms of anger, but rage relates to a stronger form of anger, and fury usually refers to an even more intense form of rage. Mild forms of anger include irritation, annoyance, and touchiness (see Lomas, 2019). Frustration is on one hand part of anger and on the other hand closely related to anxiety, since the situation of not being able to reach a desired goal produces frustration and often also anxiety (for eco-anxiety and frustration, see Pihkala, 2020a).

During the last year, "eco-anger" has received a first focused wave of research interest, but studies related to it are still very few (Kleres and Wettergren, 2017; du Bray et al., 2019; Stanley et al., 2021). This is another major omission in research about climate emotions, because analysis of surveys and interview studies shows that people often have feelings of climate anger. In the Finnish national climate feelings survey, 44% recognized climate frustration, 31% climate anger, 28% climate irritation, and 16% climate rage (Hyry, 2019). Based on the free answers that respondents could give, many people were furious about the lack of ambition in climate politics, and several were furious because of a position of climate denial: they were angry that there was any public discussion about climate matters. In an American survey, 44% reported climate anger (Smith and Leiserowitz, 2014). In a recent international study, 57% of the young respondents told of feeling angry about climate change (Hickman et al., 2021).

As Antadze (2020) suggests, there seems to be a strong need for further differentiation between various forms of climate anger and rage, and more research about these. Antadze insightfully explores the philosophical foundations for moral outrage because of the climate crisis.

Hostility, Contempt, Feeling Discontent, Aversion

This array of emotions refers to a felt sense of hostility toward topics related to climate change. These affective dimensions often include anger, feelings of aversion, and even disgust. These kind of emotions have been found among climate deniers (Wang et al., 2018; Haltinner et al., 2021). More broadly, people have feelings of contempt toward others who do not share one's opinions on climate politics. This kind of "climate hostility" or climate contempt can manifest both toward climate skeptics and toward active proponents of climate politics. An unpublished research manuscript (Webster et al., 2021) studies partisan schadenfreude in relation to climate change in the US, and there are also some other observations of "climate schadenfreude" (e.g., Cox et al., 2018).

This array of emotions can also include feeling bored because of climate change (e.g., Hyry, 2019). In the Finnish national

survey, 32% self-recognized feelings of skepticism and doubt toward climate matters, 27% said they felt "fed up" or bored about climate matters, 22% felt aversion ("vastenmielisyys" in Finnish, a mild form of disgust), and 15% self-recognized feeling rejection or denial (Hyry, 2019). In a recent research article on sociology, Neckel and Hasenfratz (2021) argued convincingly that it is very important to pay attention to various emotions of hostility when discussing climate emotions, so that researchers do not give an impression that only those people who feel for example climate grief are emotional about the subject. The range of climate emotions includes also hostile emotions.

Envy, Jealousy, Admiration

Envy is a rather fundamental emotion in interpersonal relations, but one that has received very limited attention in relation to environmental issues (see, however, the reflections about jealousy in McGrath et al., 2018). Due to lack of research, it is here only pointed out that this emotion seems to be, based on theory and analytical observations, an important one also in climate matters. People may feel climate envy because they desire something that others have in relation to the climate crisis, such as better possibilities to adapt, more resources, or more social acceptance (cf. the discussions about closely related emotional dimensions, without using the term envy, in Weintrobe, 2021; Verlie, 2022).

Various scholars use, once again, different concepts for related emotions. Some prefer envy and others discuss also jealousy. Lomas (2016) uses the concepts of vicious envy and emulative envy to describe two major forms of envy: one that is ethically problematic and one that includes much adaptive potential. In vicious envy, a person wants something that the other has, no matter the cost or the potential damage to the target of the envy. But envy can also have an emulative, admiration-based side, which sparks constructive action toward some valued goal. This links with Landmann's (2020) discussion about admiration as an environmentally relevant emotion.

It seems clear that both kinds of envy exist in relation to environmental and climate matters. There is vicious envy, combined with hostility, toward something valuable that others have in relation to the ecological crisis. But there is also emulative envy and admiration, which spark development of self and one's behavior: think of a neighbor who sees solar panels on the other neighbor's roof and wants to be no less clever. In Lomas' scheme, emulative envy is closely tied with a desire for self-development, following the examples of admired others. In this broad sense, emulative envy and aspiration become joined with motivation, which is a crucial thing related to environmental behavior.

Motivation, Urge to Act, Determination

This group of emotions is related to a felt desire to do something good. There are linguistic difficulties in coining a general term in English for these emotions: benevolence is related, but it does not include the action tendency. "Feeling motivated" is one important aspect, and there is indeed much research literature in environmental psychology about motivation for pro-environmental behavior (e.g., Martiskainen et al., 2020). Another aspect is feeling interest toward climate matters, which has been a prominent climate emotion in some surveys (e.g., Hyry, 2019).

Marczak et al. (2021) found "an urge" that people who experience eco-anxiety feel for pro-environmental behavior. Lertzman (2019) uses the term "aspiration," and psychodynamic climate scholars discuss the Kleinian concept of reparation in relation to this (Weintrobe, 2013). Because of the ubiquity of feelings of guilt and shame, many people not only feel general motivation to do something good related to environmental issues, but they feel an urge to make up in some way for the felt earlier transgressions by themselves or by the groups that they associate themselves with. In the Finnish climate feelings survey, 31% self-reported feelings of desire for reparation in climate matters (Hyry, 2019). Other closely related emotions are regret and remorse (see also section Guilt, Shame, Feeling Inadequate, Regret above).

Determination is a feeling intimately related to the aforementioned ones. Determination can be conceptualized as a strong form of motivation and willingness, pointing to an enduring character of willing. The virtues or attributes of courage, endurance, and strength of will are indeed close to determination. Verplanken et al. (2020, 7) found feelings of determination in their research about eco-anxiety. Hamilton (2020) observed that emotion-focused methodologies enabled many participants to develop strong feelings of determination for pro-environmental behavior. Either implicitly or by using various different terms, this dimension of feeling motivation, urge to act and determination is discussed in many studies, but there are currently no widely used keywords to capture this (for examples, see Verlie, 2019; Verlie et al., 2020; Hiser and Lynch, 2021). Some scholars use the formulation "being moved" to describe a related emotion (Landmann, 2020; Stollberg and Jonas, 2021).

Pleasure, Joy, Pride

This group of emotions refers to pleasure and "good feelings" that pro-environmental behavior or removal of environmental threats can engender. Another emotion connected with these is relief, which clearly exists in relation to environmental issues, but is little discussed in literature, except in relation to the theme of human well-being in natural environments. "Feeling content" is another aspect of this group of feelings, as is happiness (see the discussion about the possibilities of flourishing in the climate crisis by Doherty, 2018). Overall, there is a certain lack of research about these positive emotions and climate crisis.

Landmann (2020) categorizes "Hedonistic Emotions (Joy, Pleasure, Amusement)" as one important part of eco-emotions. Two other categories in her scheme also apply here: especially "Self-praising emotions (pride)" and partly "Other-praising emotions (Elevation, Admiration, Awe, Being Moved, Gratitude, Love)." Again, the categorizations of self- and other-orientation seem complex here, given that for example pride can also be collective and admiration can also be directed toward oneself. Feelings of gratitude might perhaps deserve a section of their own, because they can be directed also toward ecosystems and more-than-human creatures (Macy and Brown, 2014; Hamilton, 2020). Love is discussed below in connection with empathy and caring.

People can feel joy, pleasure, and happiness when they participate in pro-environmental activities, such as climate activism (e.g., Pickard et al., 2020). They can also feel various amounts of pride (Bamberg et al., 2018). There is growing scholarship on eco-pride and debates about the relative practical benefits of it and eco-guilt. Some scholars argue that eco-pride is more motivating than eco-guilt (Bissing-Olson et al., 2016), while others point out that in certain situations guilt also has its positive possibilities (Jensen, 2019; Adams et al., 2020; Fredericks, 2021). However, it seems that people often feel complex combinations of emotions: for example, it is common to feel both guilt and pleasure in relation to one's environmental behavior and attitudes (e.g., Randall, 2005; Lertzman, 2015).

Hope, Optimism, Empowerment

A certain emotional position is characterized by optimism and empowerment. However, philosophers have argued that it would be important to keep these two separate, because there can be empowerment also without strong optimism (Eagleton, 2015). This issue is closely related to the debates about various forms of "hope" and evaluations of them in the context of the ecological crisis (e.g., Ojala, 2017; Pihkala, 2018). The concept of hope is used in various connotations, and there is a strong need to inquire further about the actual meanings of "hope" for various people and scholars. For some people, hope equates wishful thinking, while for others, hope refers to "radical hope" or "gritty hope," which is not tied with optimism—at least not as strongly.

As was seen in the Results, numerous studies about climate emotions have inquired about climate "hope," but there are less studies which have used careful definitions of hope and optimism. Because of that, there is uncertainty about how many people feel optimism and how many feel radical hope or gritty hope. Ojala's studies about "constructive hope" and "hope based in denial" in relation to climate change have been more precise (for an overview, see Ojala, 2017).

Some studies have charted climate-related empowerment and some have included excitement or enthusiasm. In the Finnish climate feelings survey, 20% of respondents self-recognized climate enthusiasm, and only 13% climate empowerment. Thirty-six percentage said to feel climate hope (Hyry, 2019). Among more closely defined groups, such as climate activists, there seems to be both stronger enthusiasm and stronger despair (Hoggett and Randall, 2018; Nairn, 2019; Pickard et al., 2020). Martiskainen et al. (2020) found that although many climate activists felt "disempowered," 23%, many also felt "hopeful," 35%. In their study of students, Hiser and Lynch (2021) noticed many feelings of being "inspired" and some of being determined and motivated. In a recent global study, 31% of the young respondents recognized feeling climate optimism (Hickman et al., 2021).

Belonging, Togetherness, Connection

Feelings of togetherness are closely linked with empowerment, hope, pleasure, and joy. In their study about environmental activists, Landmann and Rohmann (2020) coin the feeling of "being moved by protest:" feeling "positively overwhelmed by the idea that together they can make a difference." It is a noteworthy observation that there can also be positive feelings of overwhelm in environmental matters, in addition to the commonly felt negative ones (see section Strong Anxiety, Depression, Despair above).

Feelings of belonging, togetherness, and connection can be felt between humans and they are common in activism (e.g., Pipher, 2013; Pickard et al., 2020). These emotions can also be felt with the more-than-human world. Many ecopsychologists argue that such feelings of affiliation are a fundamental basis for caring about climate matters and other environmental issues (e.g., Stoknes, 2015).

Many different emotion words could be used to describe various connotations of the affects that togetherness can generate. These can include feeling elevation and awe (Landmann, 2020).

Love, Empathy, Caring, Compassion

Various emotions of caring and warmth are grouped here together. These are closely connected with affiliation and togetherness, discussed above. People feel caring strongly toward their in-group and their valued connections, but it is possible to cultivate compassion and empathy to extend also to out-groups and indeed the whole more-than-human world. This kind of love and kindness is the aim and foundation of many ecophilosophies and ecopsychologies (e.g., Macy and Brown, 2014). Hamilton (2020, 159) noticed feelings of love and connection in the participants of emotion-related workshops around environmentalism, such as the ones based on the work of Joanna Macy. People may also feel sympathy (e.g., Jovarauskaite and Böhm, 2020).

Climate matters are a somewhat abstract target of caring and love, but because climate matters are intertwined with everyday lives, "climate compassion" can be practiced by caring for others and places affected by the climate crisis. Indeed, it has been argued that caring is the foundation of numerous other climate emotions, such as climate grief (Cunsolo Willox and Landman, 2017), climate guilt (Jensen, 2019), climate anger (Antadze, 2020), and climate anxiety (Hickman, 2020). Because people care for ecological well-being, they are saddened by losses related to it, they feel guilt if they think that they participate in the damaging, and they feel anger because of the systemic problems which cause ecocide. Eco-anxiety may arise from a feeling that something needs to be done, based on caring, and the experience that it is difficult to choose the right emphases or to get enough done (Pihkala, 2020a).

STRENGTHS, LIMITATIONS AND NEEDS FOR FURTHER RESEARCH

This study inquired which climate emotions feature prominently in existing research. Based on both general emotion research and interdisciplinary research on eco-emotions, this study also explored which climate emotions would seem to deserve more attention, even though they have not yet been much studied in relation to the climate crisis. The study provided an initial taxonomy of the prominent and potentially prominent climate emotions and discussed these emotions in relation to interdisciplinary environmental research. It has been emphasized

that this was a preliminary study: the semi-systematic and narrative reviews in this study provide material for more systematic reviews to be done in the future.

This study had many strengths. For the first time, it provided an initial taxonomy of climate emotions, building on pioneering research on the topic (for an overview, see Hamilton, 2020). It brought together general emotion research and eco-emotion research, even while much work remains to be done in the integration of these research fields. It applied the pioneering taxonomies of eco-emotions, especially Landmann's (2020) work, into the topic of climate emotions, and it extended this taxonomy on the basis of wide literature reviews and interdisciplinary discussion. For example, this was the first time, up to the author's knowledge, that envy/jealousy was explicitly discussed as a climate emotion. The moral dimension of many climate emotions was now explored further, including such emotions as disappointment, disgust, moral outrage, and desire to act. The array of emotions related to the climate crisis gained much new nuance and for example surprise-related climate emotions received fresh attention. While the focus was on climate emotions, many discussions in this article may help to gain insights also in relation to eco-emotions in general. With this initial taxonomy, the design of future studies about climate emotions will be made easier, even if researcher decide to use other approaches in emotion theory than the broad one used in this study.

This study also had several limitations and challenges. Some of these arose from the complexities of general emotion research. There are many different uses of concepts and many different understandings of affective phenomena. The term emotion was used broadly in this study, referring to both bodily reactions and conscious feelings—and complex combinations of these, and future research should explore in more nuance the character of various related affective phenomena. It seems evident that there are, more strictly defined, many kinds of affects, emotions, feelings, and moods related to the climate emotions discussed in this article. Both the theoretical aspects of these emotions and the lived experiences of them need further scholarly attention, and the new kinds of climate emotions perceived in this article merit special attention.

Interdisciplinary was both a strength and a limitation. On one hand, it provided much new information, but on the other hand, it made a full systematic review rather impossible. It is hoped that this interdisciplinary study, consisting of semi-structural and narrative reviews, would motivate further co-operation between various disciplines. The importance of doing more systematic reviews with meta-analyses in the future has been mentioned several times in this article. This preliminary effort was done by a single scholar, and in the future, double coding of emotions would be beneficial. There are naturally many different possibilities of naming and categorizing the climate emotions discussed here. However, the greatly varied nature of relevant sources will continue to bring challenges to future research.

It is important to note that this research does not claim that the studied climate emotions are universal. The profound array of various factors which shape people's experiences of emotion and their ways of naming emotions were mentioned in the article. These issues are also relevant in relation to the sources. Many of the existing sources focus on people in industrialized countries and there is some emphasis on certain groups of people, such as environmentally-minded citizens. In the future, there is a need to further extend the empirical studies to many different groups of people. There are already some national-level surveys of climate emotions and some international surveys, but these depend on self-recognition of emotions, and need the support of various interview studies and field observations. The certain bias in the sources is somewhat balanced by the existing work among some indigenous peoples, but postcolonial perspectives clearly need more attention. It can be presumed that some of the emotions that are explored here in more detail than in much previous research, such as feeling betrayed and envy, may feature more prominently among people who suffer from intersectional injustices. There is also a need for studies about climate emotions in different languages: here, only English and Finnish were used.

This study identify gaps in the literature. The initial taxonomy that was developed can already now inform research about pro-environmental behavior. It can help develop therapeutic interventions and foster personal insight by bringing attention to the wide range of climate emotions. It may also contribute to thinking about public health policies in relation to climate change for example by pointing out that there are various forms of climate sadness and climate grief, and not all of these require medical attention. The article has increased our knowledge about climate emotions, which makes it possible to apply its results in behavior or influence programs, even though the relationship between emotions and pro-environmental behavior seems to be complex and partly context-dependent. The great urgency of the climate crisis strongly highlights the need for more climate research, including research about this preliminary taxonomy of climate emotions.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary materials, further inquiries can be directed to the corresponding author.

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

FUNDING

This research was funded by the Finnish Cultural Foundation, a personal grant which was granted in February 2019. Open access funding provided by University of Helsinki.

ACKNOWLEDGMENTS

The author expresses gratitude for several scholars who commented on various parts of this manuscript: Dr. Thomas Doherty, Dr. Blanche Verlie, and Dr. Essi Aarnio-Linnanvuori. Thanks also to reviewers for insightful feedback about how to improve the article.

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Conflict of Interest: The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.